NATURE MAGAZINE

y, 1945 35 Cents Vol. 38, No. 5

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Over on the dark side is this: Every unnecessary thing you buy helps shove the country one step nearer inflation and the bad times that come in inflation's wake.

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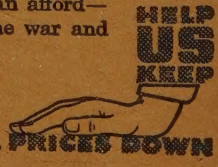
2. When you buy, pay no more than ceiling prices. Pay your ration points in full.
3. Keep your *own* prices down. Don't take advantage of war conditions to ask more for your labor, your services, or the goods you sell.
4. *Save.* Buy and hold all the War Bonds you can afford—to help pay for the war and protect your future. Keep up your insurance



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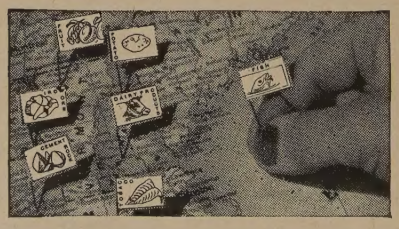

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Nature in Print

By HOWARD ZAHNISER

"If boys and girls can be brought to see that non-poisonous snakes are the farmer's friends, and that some hawks are actually beneficial, a grand step will be made in the right direction," says Joseph A. Cocannouer in suggesting some of the details in an educational trampling out the vintage where the grapes of wrath are stored in American agriculture. Such a detail he includes in what he calls "illustrations of minor importance," yet a reader of his autobiographical book entitled *Trampling Out the Vintage* can even so see in the suggestion an evidence of progress. In the boyhood days of which Mr. Cocannouer writes the farmers of the Oklahoma lands on which he himself lived seemed to him woefully uninformed about the natural resources on which their lives depended, and uninformed regarding the means whereby they might best obtain their own livelihood. More boldly, Mr. Cocannouer might be paraphrased as saying that these farmers did not know their own business. His autobiography is a narrative of the part that he has played in the progress that has been made toward a more intelligent agriculture.

Interestingly enough, Mr. Cocannouer's first access to his farmers' minds in his educational "mission" was gained through their tolerance of "Nature study" in the schools to which they sent their children to learn the three R's from Schoolmaster Cocannouer. It was an approach suggested by Dr. Lewis of the Oklahoma Agricultural and Mechanical College. Urging Mr. Cocannouer to become a rural teacher, Dr. Lewis said:

"Haven't I heard you say that your chief ambition was to go back to your part of the country and teach those people a new agriculture?"

"Yes," Mr. Cocannouer replied, "but in school . . . they don't teach agriculture in country schools! I don't see how it could be done."

"Anything can be done when there is a will to do it," Dr. Lewis assured him. "Of course your chief duty would be the teaching of the three R's; yet there is no law against your organizing a course in Nature study, say. You could call it Nature study."

How Mr. Cocannouer succeeded in obtaining a school to teach, in establishing himself as master, despite a girl bully who even in print seems most formidable, and in introducing his "Nature study" seems to be the most interesting and significant part of his autobiography, with the possible exception of his account of the influence of his mother, who opened a vigorous garden season each spring when she "heard the first pewee" and who taught her son his first lessons. Her son saw her read "the world of Nature . . . with a strange intelligence," and he saw in her "a deep, silent determination to win, no matter what the odds." Of her, Mr. Cocannouer writes one eloquent paragraph that can hardly escape quotation:

"In my later years," he recalls, "during my varied wanderings over the earth, her fighting strength was my measure for the skill and courage of the tillers of the soil in strange lands. While I watched a Chinese cultivate his soil as if it were the earth in a rare garden; or a wild man in the hill country of the Philippines digging in his sweet potato field; or a modern Egyptian cultivating the still fertile soils of the Nile; or the Italian or French or German gardeners fighting to get maximum production from soil that had become almost artificial through long and persistent fertilization; or the gardeners of Holland—the home of my mother's ancestors—beside each of them I could always see her working in her garden in the Oklahoma sand hills, worn by her labor, often with despair in her heart, but never surrendering."

Of these wanderings in foreign lands, especially of the years during which he taught agriculture in the Philippines, Mr. Cocannouer writes at some length and with interest, yet none of his tale seems more adventurous than that part which tells of his early attempts to instruct farmers through the intrigue of engaging their children in "Nature study." In his McGuffey readers he listed the selections that touched upon farm life and from each sought to "bring out at least one vital lesson dealing with some phase of agriculture: about the care of soil; how to grow the best wheat or corn or cotton; gardening; livestock—anything," he says, "I could work in between the lines." Later he led his pupils into making a Nature study class out of the traditional Friday afternoon "program."

Trampling Out the Vintage is a rather individualistic book, in many ways. There is no table of contents, no index, no chapter titles, not a single date that I can recall following the copyright notice, and a sparing use of given names, initials, and identifications of individuals. Dr. Lewis is Dr. Lewis. Fortunately the pages are numbered, thus making it much easier than otherwise to make notes and later refer to the passages noted. Fortunately, also, the book makes interesting reading from start to finish and leaves its reader with a sense of satisfaction in having shared the experiences of one of the many Americans who through what is perhaps best known as extension work have helped farmers create a remarkably efficient agriculture in this country.

Mr. Cocannouer's concluding reflections, given thoughtful expression in some two dozen or more pages, are concerned not only with the progress he has seen and the advances he hopes for in farming but also with the education of Society to "turn its eyes back towards the soil."

"Here it seems to me," he points out, "is the next vital move in agriculture: teaching the public to view the farm with understanding once again. Narrow the gulf until every business and professional man and woman can reach across it and extend to the tiller of the soil a willing, helpful hand."

The pumpkin far out in the brambles, he says in a figure of speech shaped out of his own experience, must still be fed from the mother roots.

Trampling Out the Vintage has in some way recalled a volume of verse published last summer by Nellie S. Richardson under the title *Once Around the Sun.* Perhaps it is the interest in gardening that Mrs. Richardson might have shared with Mr. Cocannouer's mother. Perhaps, and more likely, it is the contrast between the realism of the farm life that Mr. Cocannouer describes and the sentiments for rural things that Mrs. Richardson has expressed in her verses. Both, of course, are real, though one can hardly help but feel that there is more vitality and inspiration in Mr. Cocannouer's struggling idealism than in Mrs. Richardson's lovely idealizing.

In many communities there is someone who has the grace in living, the sweetness and light, to fashion into verse the idealizing thoughts and sentiments that many men and women share. Mrs. Richardson is that sort of person, and she has a competence in prosody that results in verse that goes trippingly on the tongue as it should. She writes in *Once Around the Sun* first "From My Garden in Ox-bow Valley" (in Vermont) and

Suggestion

By PAUL CHURCHER

April, if you're so delighted
That the winter ended, why
Are you hourly undecided
Whether you should smile or sigh?
You remind me of the zero
Hour before last year's elections,
Quixotic as Cervantes' hero
Riding off in all directions.
Spring, I make this resolution:
For a month so glumly-gay,
There is only one solution—
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then a group of poems called "Wintering South" but reading as though it might nicely have been called "Wintering South and Remembering North." She writes of her garden, of flowers and birds, of characters, of her own experiences and reflections. The railroad whistle, she writes, "is lonelier than fall days."

And none may understand it,
For no one really knows
Why the world seems full of sorrow
When the railroad whistle blows.

Once Around the Sun is as wholesome homely verse as one might wish for in a cosy moment, and there is one poem called "The Lost Name" that stands out with a simple magic:

I always thought it a burning shame
He couldn't tell us his rightful name,
But when we questioned he'd smile and say,
"I lost it out in the woods one day."

So we called him Jack; he said, offhand,
"It's an easy name to understand."
But nights, at time of the first hoar-frost.
He'd try to think of the name he lost,
Would shut his eyes and pucker his brow,
And cry, "I have it! I have it now!"

Like a breath of wind from far hills sent,
Whatever it was, it came and went.
So we called him Jack. But what a shame
For the woods to steal a brother's name!

Trampling Out the Vintage. By Joseph A. Cocannouer. Norman, Okla.: University of Oklahoma Press. 1945. 221 pp. $2.75.

Once Around the Sun. By Nellie S. Richardson. Boston: Bruce Humphries, Inc. 1944. 141 pp., with frontispiece portrait of the author and foreword by Honorable George D. Aiken of the United States Senate. $2.

Jackson Hole Bill

Representative Peterson of Florida has introduced a bill, H.R. 1292, that should care for all reasonable objections raised against the proclamation of the Jackson Hole National Monument. It provides for payments to the State of Wyoming for losses in tax revenue sustained through the withdrawal of the lands for the Monument, and guarantees rights within the exterior boundary of the area. Passage of this measure should answer any questions legitimately raised in opposition to the Monument. Continuation of the opposition in the face of this proposal will certainly belittle the sincerity of the opponents.

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It is seldom that anyone becomes a writer until he (or she) has been writing for some time. That is why so many authors and writers spring up out of the newspaper business. The day-to-day necessity of writing—of gathering material about which to write—develops their talent, their insight, their background and their confidence as nothing else could.

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Contents Noted

BECAUSE we are an editor, and so presumed to influence public opinion, we are on many mailing lists. We are urged to espouse the cause of Mihailovich as against Tito and Subasich. We are importuned by the London Poles as against the Lublin Poles. We are kept advised by the Swedish Information Service as to how the Swedes are managing neutrality, and by the French Information Service as to how De Gaulle is meeting the problems of France, with whose armies, incidentally, we served in World War I. We read all these releases and pamphlets, and we have formed certain opinions. Yet we find ourselves in a peculiar state of combined frustration and relief—frustration at being the editor of a publication aloof from the political, social and economic ills of the world; relief that we may turn to the more orderly process of Nature for material to use up the precious white space of our pages. But for an unfrustrated moment, and whether the State Department likes it or not, we will assert that we think Mihailovich has gotten a dirty deal. Now we will go back editing the article on insect legs, about which the State Department cares not a whit.

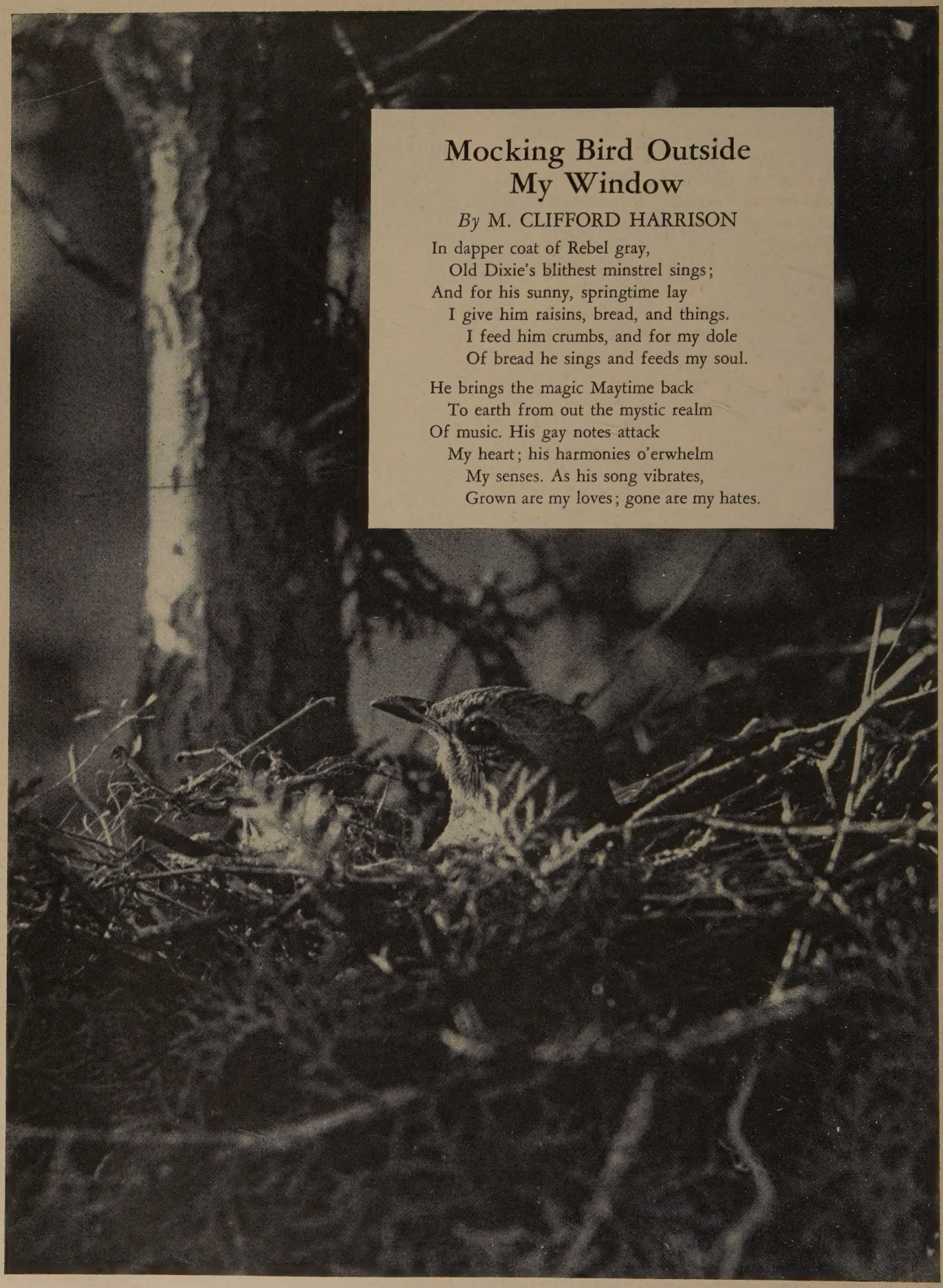
THERE should be little doubt by now of the hazards of life in the jungles of South Pacific islands. One of these was unanticipated. GI's supplied with sleeping hammocks hung these between trees and crawled in under a mosquito netting canopy that hung to the ground. Termites ate their way up the netting and across the hammock, cutting it like scissors in a single night, and dumping surprised fighting men on the dank jungle soil. Termites do not like nylon, however, and, besides, it resists mold, dries quickly after rain and weighs less than cotton. So it's nylon for netting now, and no nylons for stockings, girls, until the Nip is nipped.

A CUBIC inch of white pine, weight for weight, is stronger than common steel; air-dried, it will support the weight of nearly two and one-half tons, lengthwise of the grain. This little chunk of wood contains between four and five million cells of a type called "tracheids"; placed end to end, these cells would reach more than ten miles. Chemically, about one-half of white pine is cellulose, from which photographic film, rayon, cellophane, smokeless powder and other products are produced. Organic matter constitutes approximately 99 percent of the wood, which also includes one-third of all known elements. Less than one percent is mineral matter and is left around as ash when the wood is burned. This comes from the soil. All this is figured out by Dr. Carl C. Forsaith of the New York State College of Forestry, which is why we tell these things with such confidence.

OPERATING offshore near East London, South Africa, a trawl net brought up from forty fathoms a strange, bright-blue fish, five feet long. It was covered with heavy bony scales and its fins were fleshy and like limbs. It had a large, fleshy tail, and, on the end of that, a smaller tail. The trawler captain saw he had something strange and the mounted skin finally made its way to Rhodes University, Grahamstown, South Africa, where the fish was christened scientifically, *Latimeria chalumnae*. It was a delight to ichthyologists because the nearest known relative to this fellow lived more than sixty-five millions years ago. It was a sort of evolutionary throwback, its relatives having long ago quit the brine and adapted themselves to shore-going habits, their fins developing into legs and starting the land invasion of backboned animals. If you want to see this fish, however, you will have to visit the Chicago Museum of Natural History, where a model is exhibited in the Hall of Fishes.

BECAUSE it is so definitely mathematical—and we do not have that kind of mind—much in astronomy mystifies us. Perhaps for that reason we are specially awed by the fact that the astronomer can say that on a certain day, at a certain moment, twenty, thirty or a hundred years hence, there will be an eclipse of the sun—as Mrs. Lewis does in this issue. We wish we were sufficiently confident of the wisdom, good intent, sincerity and brotherly love of those who soon will try to build a permanent world peace, and were certain that mankind will not have wiped himself off the face of the earth in a war of rocket missiles and death rays before the eclipse of 1979 takes place.

R. W. W.



Mocking Bird Outside My Window

By M. CLIFFORD HARRISON

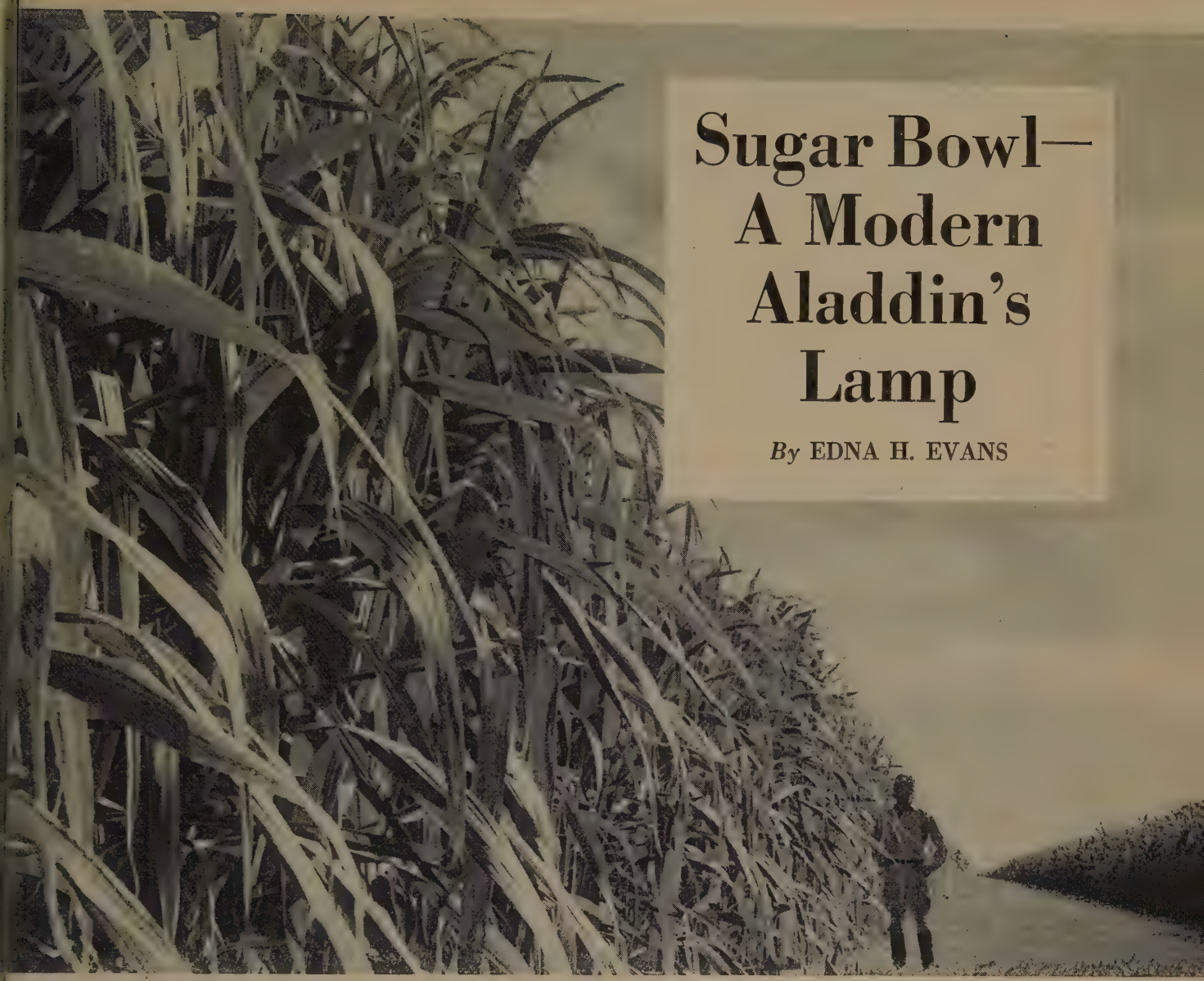
In dapper coat of Rebel gray,
  Old Dixie's blithest minstrel sings;
And for his sunny, springtime lay
  I give him raisins, bread, and things.
    I feed him crumbs, and for my dole
    Of bread he sings and feeds my soul.

He brings the magic Maytime back
  To earth from out the mystic realm
Of music. His gay notes attack
  My heart; his harmonies o'erwhelm
    My senses. As his song vibrates,
    Grown are my loves; gone are my hates.

PHOTOGRAPH BY LORENE SQUIRE

Sugar Bowl—A Modern Aladdin's Lamp

By EDNA H. EVANS



Great green forests of sugar cane grow taller than a man in the plantations of the United States Sugar Corporation in the Everglades of Florida.

SUGAR is no longer just a sweet flavoring to put in your morning coffee, nor the main item in the fudge the young folks like to whip up in the kitchen. The sugar bowl is a twentieth century Aladdin's lamp, for science has discovered, and doubtless will continue to develop, more and more uses for sugar.

Sugar is used in the manufacture of plastics, explosives, glue and dozens of other products, such as cement, dental cream, embalming fluids, soap and waterproofing materials. It is possible to go through the alphabet, listing sugar uses under every letter, from acetone to lubricating preparations, and from macaroni to yeast cultures.

In fact, from sugar can be made motor fuel to keep the automobiles and airplanes of the future running, and from sugar also can come a portion of the synthetic rubber tires on which those sugar-propelled vehicles will continue their travels across the earth.

But despite its entrance into industry, sugar remains an important item in the diet of human beings, and of their domestic animals. It also will continue to play a major role in making foods palatable, and will help in preserving otherwise perishable foods for future use.

Sugar has played an important part in the war, serving as an energy-giver, life-saver and life-sustainer. In the form of candy, it comprises the three emergency rations used by the Army and the Air Forces. Field ration D consists of three four-ounce bars of chocolate fortified with vitamin B-1. The life-raft and pocket lunches are both all-candy rations.

The Navy, too, uses sugar in its emergency ration. This Navy ration, intended to sustain the survivors of torpedoed craft and victims of other sea disasters, was developed under actual test conditions by fifteen men who spent four days and nights on a life raft in the Gulf of Mexico. Their sole nourishment dur-

ing that time was prescribed supply of hard candy.

This life-saving role is not the only one played by sugar in the war. Sugar, transformed into industrial alcohol, is used extensively in the manufacture of explosives. Thus, in addition to marching with the Infantry, flying with the Air Corps, and sailing with the Navy, sugar is also hurtling at the enemy in every bomb dropped and in every grenade thrown.

So many uses have been found for sugar that there is scarcely a war commodity in which sugar is absent. Normally, blackstrap molasses, a by-product of the sugar refining industry, is the chief source of industrial alcohol, already mentioned in connection with explosives. From industrial alcohol also comes more than fifty percent of all the butadiene used in the synthetic rubber industry.

Another important industrial use of sugar is in the manufacture of plastics, that highly versatile material that can be used to make everything from doorknobs to bathtubs, from costume jewelry to furniture. In the airplane industry the "greenhouses" on fighter planes are formed of transparent plastic.

All told, sugar today has more than seventy known and distinct industrial uses.

There is sugar in every one of the food packages sent to war prisoners. It also has been used liberally at relief stations for war refugees, and distributed to the undernourished populations in countries retaken from the enemy.

In the postwar period, with anticipated world-wide food shortages, which will continue long after the last shot is fired, populations will have to be fed diets containing high proportions of carbohydrates—of which sugar is one—since these types of foods supply, at a minimum cost, the maximum amount of energy per acre of land required for their production. Demand for sugar will continue very actively.

This war has taken a great toll of natural resources. The billions of gallons of gasoline used by motorized armies, fleets and armadas of the skies can never be returned. They are gone. But the generations of the future may still have synthetic fuel, made from sugar—as well as the many other sugar products—for these can be grown as long as the sun shines and the soil of the earth remains fruitful. Thus, the sweet grains from the cane and the beet will play an increasingly important role in the postwar world.

There is a lot of cane being raised in this country—cane full of clear, sweet juice that can be pressed out, refined and transformed into sugar, molasses or any other of the many products in which sugar is used. Still more cane can be raised, sugar men claim, if the nation chooses to make fuller use of its own resources.

Sugar, as every housewife knows, was the first food to be rationed. This was because approximately seventy percent of the sugar used in this country was imported. It came from cane grown in Cuba, the Philippines, Hawaii and Puerto Rico. About twenty-three percent of the home-grown sugar came from sugar beets, while the remaining portion was supplied by cane raised in Louisiana and Florida.

Loss of the Philippines lopped off fifteen percent of the supply, while the need for ships to transport war materials cut down the amount of sugar that could be imported from other sources. Then, too, there were more uses to which sugar could be put, so civilian household needs had to be trimmed.

Those pre-war sugar ratios were fixed by law. The government assured the Philippine, Cuban, Hawaiian and Puerto Rican cane growers a set percentage of the American sugar market, and also guaranteed them one hundred percent of their own home markets. American growers were limited as to the number of acres they could plant in cane and beets. When the war came those restrictions were removed, but the physical limitations of sugar mills, as well as labor shortages, do not permit extensive expansion, while uncertainties regarding future restrictions do not encourage them.

Sugar cane is a giant member of the grass family, and it grows well in any warm climate where the soil

Harvesting the sugar cane in the Florida Everglades on one of the large plantations. Some thirty thousand acres were included in the 1944-45 harvest of the sweet crop.

s good. It is a plant with a long pedigree, so long, n fact, that its cultivation antedates written records. t was known in India more than a thousand years efore Christ. Possibly the plant originated there, for nany wild canes still growing in India show marked imilarities to cultivated species.

According to Hindu legends, sugar cane was reated when a Rajah, who wished to experience the oys of heaven while still on earth, commanded his hief magician to build an earthly paradise. The nagician laid out a garden and stocked it with many vonderful plants, among them the sugar cane. The Rajah enjoyed the garden for many years and commanded that, upon his death, it be destroyed. Only ts greatest blessing, the sugar cane, was to be distributed among his people as a memorial to the nagician's skill.

From India, sugar cane spread east to China and he Pacific islands. It also was carried west through Persia—where Alexander the Great met the "honey-bearing reed"—into Arabia, Egypt and Spain. The Crusaders learned of it during their travels, and, for several centuries, Venice monopolized a thriving ugar trade in the Mediterranean.

Before the Crusades, sugar was not known in northern Europe. Honey was the only sweetening the peoole had. Even after the Venetians built up their rade, sugar was definitely a luxury item. It was used chiefly in physicians' prescriptions. It also appeared n wealthy homes, along with pepper, spices and other rare and costly food items.

When Spanish and Portuguese sailors began their oyages of discovery, their countrymen soon estabished sugar plantations in West Africa, on the Canary Islands, the Azores and the Cape Verde Isands. Columbus carried cane and cane growers with him on his second voyage. While this first New World sugar venture was unsuccessful, more cane was brought, and, before long, the sugar industry was thriving in the West Indies. Since Indian labor was found to be unsatisfactory in the hot cane fields, Negro slaves were imported from Africa.

Yankee skippers in the English colonies took an interest and set up a thriving three-cornered business. They would pick up a cargo of molasses in the West Indies, and carry it to New England to be made into rum. Then, with a cargo of rum in their holds, they would sail for West Africa, barter the liquor for slaves and take the slaves to the West Indian plantations where they sold for a nice profit. Then, loaded with molasses again, they would sail for Yankee ports and repeat the process. As sidelines, they carried dried fish to be sold as food for the slaves, and brought back tropical fruits such as lemons to the home markets. The British Molasses and Sugar Acts, which attempted to levy duties on this trade, helped bring on the American Revolution.

The first sugar cane grown in what is now the United States was produced in Louisiana in 1771, but this was used for chewing, and it was not until some forty years later that a successful sugar refining process was employed. Cane, generally with a low sugar content, was grown in many parts of the South before the Civil War, but, both before and after that conflict, Louisiana continued to be the center of the sugar cane industry.

Cane is subject to a number of diseases. It also falls prey to the sugar cane borer moth, and to a beetle that destroys the cane plants by gnawing into them just below the surface of the soil. As the years passed, these diseases and insect enemies spread until Louisiana's output dropped from about 300,000 tons a year to a low of 47,000 tons in 1926. The entire Louisiana sugar industry seemed faced with extinction.

However, by the importation of hybrid canes from Java and India, plus additional varieties developed through the Office of Sugar Plant Investigations, operated by the U. S. Department of Agriculture at Canal Point, Florida, new types of cane were produced. These not only were more resistant to disease and insects, but also gave higher yields of sugar per acre than the plants formerly under cultivation.

From the air a plantation of sugar cane looks like a level landing field. These checker board squares of waving cane surround one of the villages built in the fields.

The sugar industry in Florida has been developing for the past fifty years, but only within the last two decades have cane growing and sugar refining been done on a really sizable commercial scale.

Sugar cane in Florida is raised in the Everglades, that vast region of flooded prairie that stretches southward from Lake Okeechobee to the Keys. The muck and peat soil formed by the decay, century after century, of marsh vegetation, is from ten to twelve feet deep, and, when properly drained, makes exceedingly fertile farming land. No wonder the cane grows lusty and tall on the rich black soil.

Louisiana's cane fields, too, are confined to the low southern parts of the state, where a long- established system of canals and flood gates control the water supply, while levees along the river keep out water that is neither needed nor wanted.

Sugar cane is a peculiar plant in that it sometimes produces seed and sometimes does not. In fact, it is a relatively recent discovery that sugar cane seeds will germinate and grow into sugar canes. Now plant breeders take advantage of this in developing new and better varieties. But, since the seed of the sugar cane does not necessarily produce a like plant, new varieties are never grown commercially from seed.

Instead of using "cane seed," sugar raisers plant "seed cane." The cane stalks, themselves, are laid in a continuous line in a tractor-plowed furrow, each piece overlapping the next by one-third of its length. When they are in place, the stalks are covered with soil. New shoots grow from each of the "eyes" on the seed cane, each bud forming a series of short joints. More buds grow from these joints so that a single row of seed cane produces a thick line of new stalks.

In Louisiana the planting season runs from August through March. The cane requires from twelve to twenty-four months to develop and the harvest months are October, November and December. In the Florida Everglades fall plantings have produced the most successful results, with August and September being the favored months. These plantings may be harvested after October of the following year, but Everglades cane can be harvested throughout the year, although the summer rainy season usually halts the harvesting operations.

In some sections of the world the cane must be replanted after each cutting. In Louisiana it must be replanted after two cuttings, while in Cuba it has been known to stand for twenty cuttings. In Florida, as many as twelve cuttings have been made from one planting. After the first crop has been cut, new shoots or ratoons grow from the stubble, and these can be harvested when they have matured into sugar canes.

When the cane is ready, it is harvested by hand. Workers, usually Negroes, go into the fields armed with wide-bladed cane knives. In one continuous motion they slice the cane off close to the ground and strip away the leaves. From the fields the cane is hauled to hoists alongside a railroad track, where the loads are weighed, dumped into railway cars and transported to the sugar house for processing.

The cane stalks are shredded and the juice, squeezed out under a series of heavy iron rollers, is passed through a liming process to correct alkalinity. Impurities are removed by filtering or skimming, and a mixture of crystals and molasses is formed. Centrifugal force is used to spin the molasses off the sugar crystals.

These raw sugar crystals are not the fine white grains to be found in the sugar bowl, although both the raw sugar and the molasses may now be sold to the consumer. Or, the raw sugar may be shipped to a refining plant to be transformed into granulated sugar and refiners' molasses.

Naturally, such an industry has by-products. The "black-strap" molasses which remains after the centrifuging is used extensively in the production of commercial alcohol, is utilized in the manufacture of cattle feed, and a small portion of it is canned and sold for cooking purposes.

Some of the cane fiber from which the juice has been squeezed is used in the manufacture of Celotex building board, but by far the greater part of it is used as fuel to keep the boilers going, for the sugar plant machinery is operated largely by steam power. The ash that remains is put back into the cane fields for whatever fertilizer value it may have.

The filter press cake, composed of impurities removed from the juice during the manufacturing process, is particularly valuable for renovating depleted soils, since it is rich in organic matter and lime.

Scientists see a glowing future ahead for Nature's gift of sugar, as food, as fuel, as synthetic rubber and in dozens of other forms and uses. Researchers of the future will, doubtless, continue to rub this modern Aladdin's lamp, and produce more and more wonders from the friendly sugar bowl of our tables

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Bouquet

By ELAINE V. EMANS

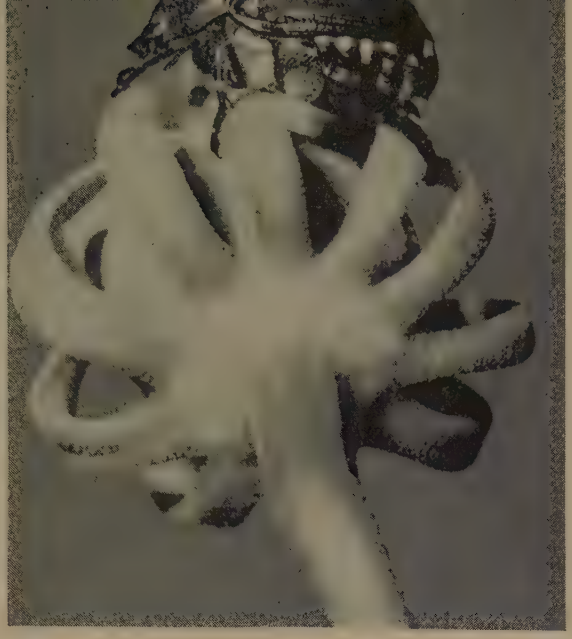
I came upon a sisterhood
Of bloodroots in an evening wood . . .
I plucked no petal, broke no stem,
But came away with all of them.

The World's Most Useful Legs

Further Adventures in an Insect Garden

By EDWIN · WAY TEALE

Photographs by the Author



THEY taste with their legs. They hear with their legs. They make music with their legs. They form insect-nets with their legs. They carry whole kits of highly specialized tools on their legs. They even produce, from glands on their legs, strange bubbles of froth used in an exotic marriage-dance performed in midair. Nowhere in the world are legs so important, so specialized, so amazing as they are in the realm of the insects.

On this late-September afternoon, I have followed the Odyssey of a honeybee across the wide, weed-filled wasteland which stretches away to the south from my Insect Garden. The rising tide of autumn goldenrod has reached its flood. Each dusty, golden, pollen mass of yellow flowers is the scene of intense insect activity. Alighting, hurrying this way and that, rising, humming from flower-clump to flower-clump, the bee that I have followed moved down the slope of the hillside. It passed, on almost invisible wings, under and over the arches of floral gold. At each stop, the masses of pollen, the bulging accumulations of golden dust, grew larger in the spine-ringed pollen-baskets on its hind legs. From time to time, I could see the insect pause in midair as, with middle legs working rapidly, it packed the pollen more solidly into these containers.

The forward legs of the honeybee also contain aids to making a living. No other insect has more useful or efficient tools than those carried on the legs of the familiar honeybee. They are equipped with grooves and combs for cleaning the antennae. They are equipped with spurs for prying loose the pollen-masses when the hive is reached. They are equipped with so-called

STRONGMAN LEGS — The legs of the beetles are the strongest among the insects. At top, a Jap beetle on a mallow bud.

POWDERPUFF LEGS— The hundreds of white hairs that spread out from the legs of the small, pinned moth are used in a kind of courtship display at mating.

BASKET LEGS — The hind legs of the honeybee are formed to carry masses of packed-in pollen. The other legs hold a whole kit of tools that aid the insect in its work.

wax-shears and with brushes formed of stiff hairs, which aid the bee in harvesting the pollen. Each foot of a honeybee, as in a housefly, possesses claws for clinging to rough surfaces and sticky pads for adhering to smooth supports. In walking, either by the use of claws or pads, the bee—like all the other six-legged insects—moves forward on tripods. It uses three legs in unison, moving the front and rear legs on one side and the middle leg on the other at the same time.

The bee's tool-kit is unique in many respects. But the legs of other insects have additional features that are unknown among these honey-gatherers. A praying mantis, for example, has its forelegs enlarged into powerful tooth-lined traps, which the insect can snap shut over the back of its prey. The small, camouflaged ambush bugs, which lurk amid the blooms of the butterfly bushes in my garden, also have huge forelegs for gripping and holding their prey. The swift-winged robber flies, which swoop down on fluttering insects and snatch them from the air like hawks, depend upon long legs ending in twin needle-sharp claws for capturing and holding their victims.

Among the insects, some species have frail legs hardly able to support the weight of their bodies. The Mayflies, during their brief existence, use their legs mainly for clinging to streamside foliage. At the other extreme, the strongest-legged of all the insects are the beetles. Some of these six-legged strongmen are slow and ponderous in their movements, while others, like the brilliantly-colored tiger beetles, can sprint in swift dashes of amazing speed in pursuit of prey, or in evading capture. So long and slender are the gangling legs of the cranefly that this insect is commonly known as the daddy-longlegs in England. In contrast, the legs of the great American silk moth, *Telea polyphemus,* are heavy-appearing and clad in in dense furry hair.

Grasshoppers and crickets sail through the air in long leaps made possible by their elongated hind legs. These legs also are equipped with spurs, like the spikes in a sprinter's shoes, which enable the insect to obtain a firm grip on the ground or on the vegetation from which it leaps. The underground-dwelling mole cricket has digging forelegs provided with movable blades, which form the natural shears with which it snips off rootlets that bar its way when it is burrowing in the earth. The nymph of the seventeen-year cicada also has its forelegs enlarged and massive in striking contrast to the relatively slender forelegs of the adult "locust."

At the Carnegie Museum, in Pittsburgh, Pa., there is preserved a cicada nymph, together with its curious victim—an exhibition that illustrates in a unique way the powerful digging ability of these immature insects. A garter snake had come upon a nymph as it was emerging from the earth after its decade and seven years of burrowing, subterranean existence. The snake had immediately swallowed the cicada—with fatal results. For the nymph, using its sharp-armed, digging forelegs, had burrowed its way outside from the interior of the snake, tearing a hole in its side!

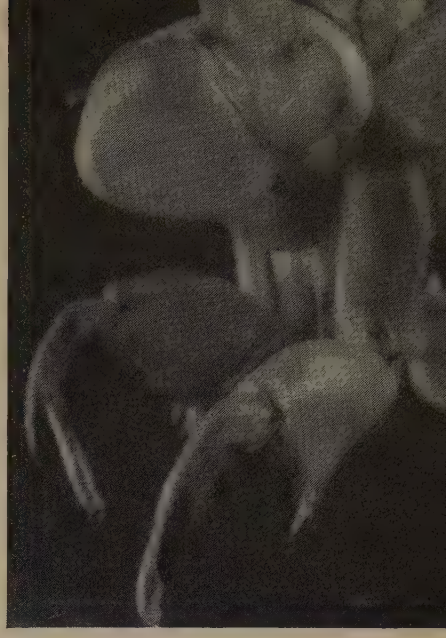
I remember once spending a good part of a morning watching green-banded digger wasps excavating their burrows in the loose sand of an Indiana dune-side. These insects, known to science as *Bembex spinolae,* are about the size of a honeybee. Begin-

TASTING LEGS—The Monarch butterfly, together with a number of other insects, can detect the presence of nectar by means of its legs, 200 times as sensitive to sugar as is the tongue of human beings.

LONG LEGS—The gangling legs of the cranefly are three times as long as is its body. The equipment of this harmless insect has given it the common name in England, and in this country, of daddy-longlegs.

HUNTING LEGS — The curved hooks at the ends of the long legs of the robber fly enable it to capture prey in midair by sinking its sharp claws into the victim.

INSECT-NET LEGS — The dragonfly folds its six spine-fringed legs together to form a net when it is in flight. The insect prey is scooped into this net and transferred to the mouth of the dragonfly, altogether a most efficient arrangement when the insect is hungry.



DIGGING LEGS—The powerful forelegs of the seventeen-year cicada nymph, whose discarded skin is shown here, aid it in tunneling through the ground

ning to dig as a dog does, they made the sand fly out behind them in an almost constant stream. Even after they had disappeared within the entrance of their tunnels, the sand grains continued to stream out as though they were being ejected by a machine. The explanation of their digging ability lies in the peculiar formation of their forelegs. They are flattened sidewise and are equipped with strong bristles along the edge that make them particularly effective excavating tools.

In connection with digger wasps, it is interesting to note that there is a difference in the number of spurs on the leg of a female cicada-killer and a male of the same species. The females of these showy black-and-yellow wasps do the hunting, the paralyzing of the cicadas, and the digging of the tunnels in which the prey is buried. She has an extra spur on her leg that assists in pushing the soft earth back away from the mouth of the burrow.

The cicada - killer, as well as the orange-banded digger wasp *Chlorion ichneumonea,* make it an almost invariable rule to clean their antennae carefully after each descent into the earth while constructing their burrows. This is accomplished by aids located on the forelegs. Ants often can be observed using the "brushes and combs" on their front legs for a similar purpose.

It is the hind legs, rather than the front ones, that provide the curious, long-legged orange-hued ichneumon fly, *Megarhyssa lunator,* with an apparatus for cleaning its trailing, threadlike ovipositor, or egg-placer. This slender drill is employed for boring down through wood to reach the hidden larvae that the ichneumon fly parasitizes. I have seen one of these insects finish its task, slowly withdraw its ovipositor from the wood and then, crossing its hind legs, pull the thread-tube through the V formed in this manner several times, in order to clean it thoroughly.

TRAP LEGS—The toothed forelegs of the praying mantis are designed for capturing prey, and the two blades can be snapped shut over the back of a victim like the jaws of a steel trap. The female mantis pictured is eating up her mate, often a climax of mating.

On, under and over the dark swamp - water that flows in a winding stream through the lowlands at the foot of my garden hillside, there are other insects employing other oddly-formed and oddly-used legs in the business of making a living. Dragon-

JUMPING LEGS — Such insects as this grasshopper owe their leaping ability to their long and strong hind legs. Spines on them dig into the ground, giving the insect a firm start.

flies, with brilliant, metallic-hued bodies, hawk about over the stream with their six, spine-fringed legs held together to form the prototype of the entomologist's butterfly net. With a sudden rush, the dragonfly scoops from the air the flying insects that form its prey. After an insect has been caught in the mesh of these spiny legs, it is transferred to the dragonfly's mouth and oftentimes consumed on the wing.

Among the submerged waterplants of the sluggish stream, backswimmers and water boatmen scull about with the aid of a pair of specially elongated and flattened legs, which form their oars. Males of the water boatmen have one peculiar use to which they sometimes put their forelegs. They rub them over their faces to produce a sound, a squeaking note that is surprisingly loud and sustained. The forelegs of another water insect, the predatory *Dytiscus* diving beetle, also has a special use. These legs are modified in the males to form cup-like suckers that aid them in clinging, at mating time, to the smooth shells of the females. Fringes of hairs on the lower parts of the two rear pairs of legs—making them look like half of a feather that has been split lengthwise—assist these diving beetles in swimming swiftly on their way to overtake their prey.

Between the underwater insects and the aerial dragonflies, other six-legged hunters are on the prowl, stalking their game across those fluid hills and valleys of the wind-ruffled surface film, aided by numerous hairs that can be spread out on each foot, and which, acting as an insect counterpart of the snowshoe, help keep the air-breathing *Gerridae* from breaking through into the water below. These hairs can be folded up like a fan into a slot in the leg of the water-strider when they are not needed.

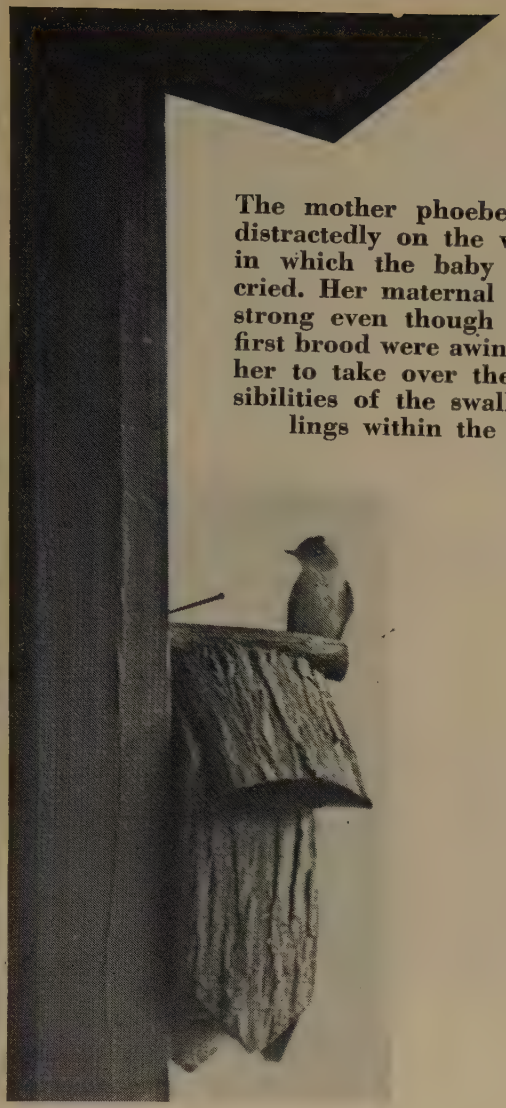
Another insect that possesses folding hairs on its legs is a small grayish moth with the scientific name of *Melipotis versabilis.* A year ago, the Eastern lepidopterist, Otto Buchholz, showed me one of these insects that he had found on a treetrunk in the pine barrens of southern New Jersey. Each foreleg was decorated with what appeared to be a white powderpuff. The mass of hairs spread out in great balls like chrysanthemums. Each of these masses of hairs was several times the (Continued on page 272)

HEARING LEGS—This angular-winged katydid hears through its forelegs. Its ears, located below the "knees," have oval openings through which the sound enters.

The Neighbors' Children

By RAYMOND S. DECK

Photographs by the Author



The mother phoebe perches distractedly on the wren box in which the baby swallows cried. Her maternal instincts, strong even though her own first brood were awing, forced her to take over the responsibilities of the swallow nestlings within the box.

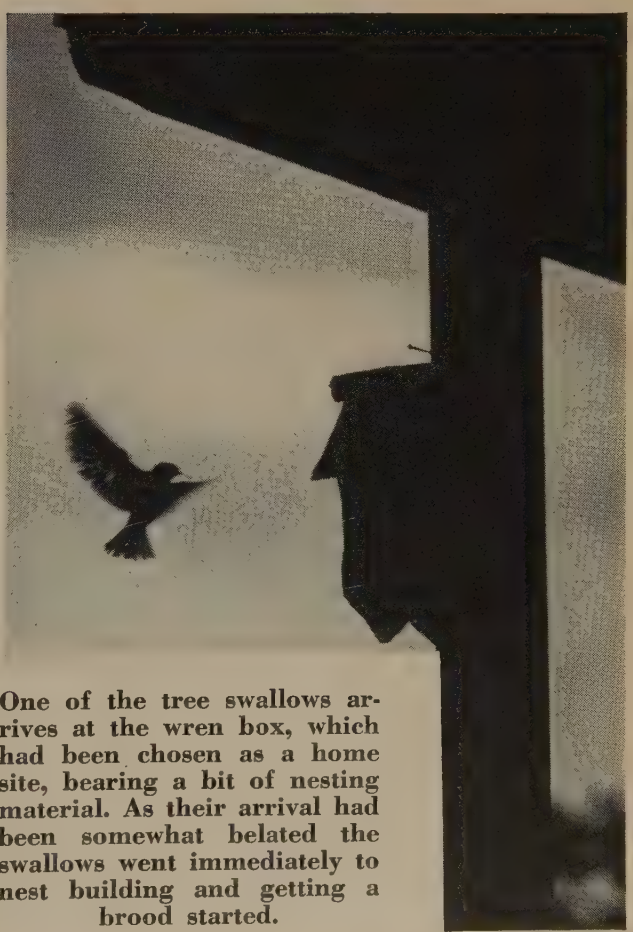
WE JUST could not believe such a thing—least of all of our phoebe. That little gray bird had always been the most strait-laced mother in feathers. We had watched her bring up nine or ten youngsters each summer for five years, as dutifully as any mother. Sure enough she had showed up with a new husband a time or two at the end of a winter down South, but we had not raised our eyebrows at that. Maybe the old one had been caught by a hawk or something. But our phoebe a kidnaper!

Now I want her to have a fair trial even if I do look askance at her whenever I see her, and have done so ever since the unsavory episode-under-the-eaves last year. Maybe I am exaggerating a bit when I call her a kidnaper, since she did not actually fly off with the tree swallow's nestlings. However, here is what happened.

In a mud-and-moss nest on the porch of our family's rural sanctuary, a pair of phoebes have reared their brood every spring since the rough lodge was built. The nestlings are always interesting mites, true enough, but they are a long, long way from being pretty. They look a good deal like tiny black monkeys dressed in white silk pajamas—monkeys with huge bulbous eyes and yellow mouths as wide as they are. Their faces are always wrinkled like little gnomes'. And such plain-looking children as that have held Madame Phoebe's unwavering maternal affection all these years, for four or five youngsters at every sitting and two sittings each year! Held it, I mean to say, until last summer.

Phoebes, as you know, are squat little birds clad in dull gray and black, and tree swallows, on the other hand, are dandies. Tree swallows are trim of line, with snowy breasts and glittering blue-green mantles. Phoebes sit stolidly on bare perches all day, monotonously twitching their tails, while swallows are forever darting theatrically about through the sky. And tree swallows sometimes come nest-hunting after every phoebe in the countryside has set up housekeeping.

Thus it happened that our last May's brood of phoebe quintuplets had already hatched in a nest on the rafter when a pair of fleet-winged tree swallows zoomed in over the pond to establish a homestead in



One of the tree swallows arrives at the wren box, which had been chosen as a home site, bearing a bit of nesting material. As their arrival had been somewhat belated the swallows went immediately to nest building and getting a brood started.

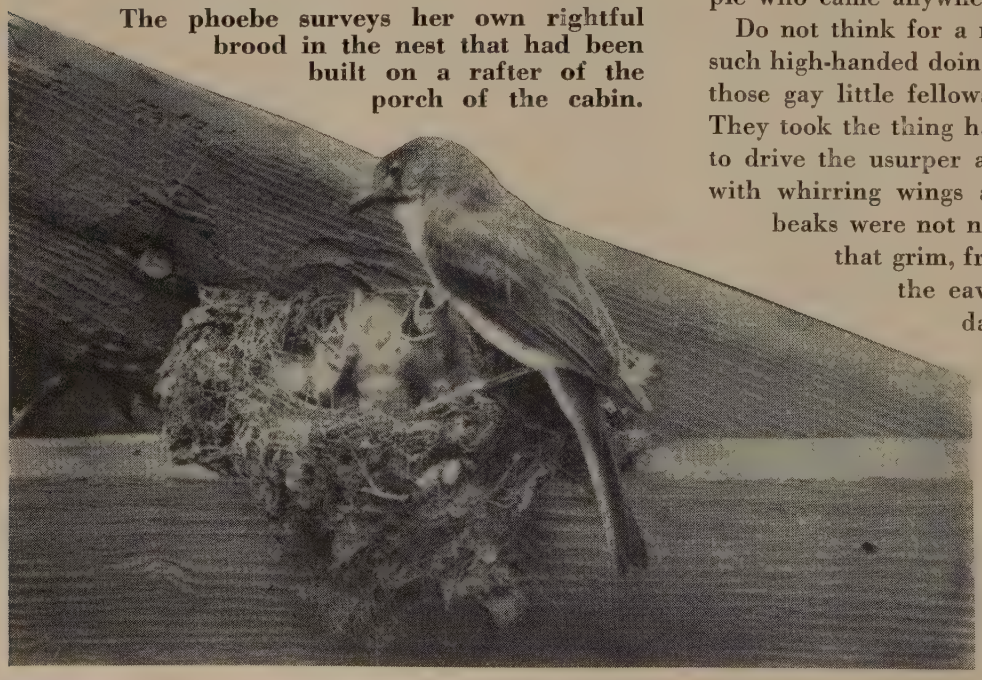
a vacant wren-box on the porch. And that is how it happened that the junior members of our family bird-club greeted their coming with squeals of delight.

"Junior" members indeed! Many is the time all four of us clustered tight by a shuttered window to watch our handsome new tenants from indoors. *Whrr-rrr!* On wings that fairly screeched with the reckless braking, we watched the sleek fellows sweep into the box for days on end, bearing grasses and feathers. When the nest was completed four white eggs were laid. And they hatched.

Shortly after, the excitement began. Mother phoebe's first brood already was, away on the wing, and had been for days past. She had tended them well in their early efforts at wing-craft and feeding. She had fetched them a thousand millers and craneflies as they perched in shady sanctuary among the leaves. But at last the time had arrived for farming them out to the *pater familias* for schooling in dodging predators and such. Mother phoebe had a secret, you see.

"*Phoe-be! phee-e-bee!*" I heard her calling as she fluttered about her redecorated apartment bright and early on a morning in June. That should have meant a white egg laid, but it did not. In the wren-box a few feet away baby swallows were crying. "*Ee-eek! eek!*" They whimpered at the swish of her wings every time the phoebe flew past the box on the way to her nest.

Well, to make a long story short, it developed that Mrs. Phoebe could not take it! She could not ignore those pitiful squeakings, so strong was her maternal instinct. She forgot all about her own plans. Maybe those nestlings were hungry or cold. And being a doughtier spirit than any swallow that ever cut a wing-spring, she just up and kidnaped the lot. That it, it was kidnaping if that term includes driving off, whenever she came anywhere about, the flashy hussy



The phoebe surveys her own rightful brood in the nest that had been built on a rafter of the porch of the cabin.

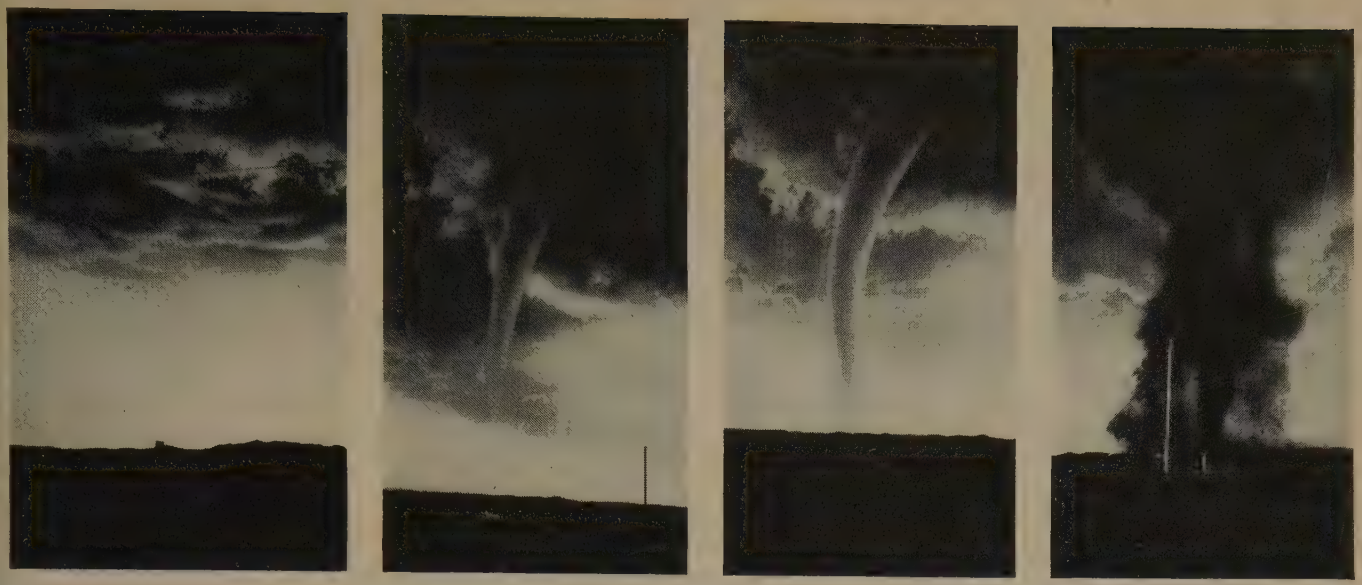
The tree swallow at the entrance to the nest box with a mouthful of insects.

of a swallow who was the nestlings' natural mother. It was kidnaping if it encompasses such well-meant ministrations as carrying crane-flies and millers to the nestlings in the wren-box every day from dawn till dark. Furthermore, she scolded off squirrels and people who came anywhere near.

Do not think for a minute that the swallows took such high-handed doings lying down. I can not accuse those gay little fellows on that, or any other score. They took the thing hard. At first they tried bravely to drive the usurper away, dashing at her together, with whirring wings and snapping bills. But their beaks were not nearly stout enough to conquer that grim, frustrated mother lurking under the eaves. So all day long, day after day, the parent swallows just swirled about in sight of the wren-box, catching dragon-flies and little beetles, watching for a chance to slip in and tend their young.

And at last they won! Within a week the self-appointed guardian of the

(Continued on page 272)



On June 24, 1930, a tornado swept toward Gothenburg, Nebraska. Photographs were taken about one-half mile to the east of the oncoming twister. First is the turbulence of the clouds before the tornado began to form; then the pendent cloud descending toward the earth; then the lower end of the cloud almost in contact with the ground; finally the dust and debris as the Quinn Ranch at Tree Canyon is demolished. The tornado was violent, its updraft sucking dry a large cistern with four feet of water in it. Buildings were demolished, heavy machinery twisted into masses of junk, trees stripped of leaves and branches, and, in some cases, even their bark.

Special factors of climate and of topography are responsible for—

Tornadoes, American Phenomena

By C. E. MILLER

About four o'clock in the afternoon of May 29, 1879, a farmer in western Kansas drove his team of horses into his wagon shed to await the passing of what appeared to be a severe thunderstorm. He hurried into his house and sat down by a window to watch the progress of the storm. He had barely settled himself into his chair when, with a terrifying roar, the storm struck.

Almost instantly the house was torn to pieces. The man was picked up and carried about thirty yards, where he struck the ground lightly, but was immediately picked up again, shifted up and down gently for probably ten more yards, and then rolled over several times.

He lay there shocked and stunned for probably several minutes. Then the brilliant lightning, the heavy thunder, and the torrential rain brought him to his senses and he rose to a sitting position, apparently uninjured. His hair and clothing were completely matted with black mud, which also filled his ears and nostrils and practically prevented him from opening his eyes. After a few minutes the heavy rain abated and he was enabled to begin an inventory of the damage done by this sudden, devastating onset.

Fortunately, the other members of his family were away when the storm struck. But every one of his buildings had been demolished and the debris scattered over several acres. The wagon shed had disappeared, but the two horses were untouched. The barn was completely razed and the boards, roof, and other timbers had been carried several hundred yards and strewn over the landscape. A cow, which had been tied inside the barn, was found on the opposite side of a small tract of woodland where she had been carried and deposited without injury. She was covered with black mud.

On Friday evening, June 23, 1944, a similar storm originated near the Ohio-West Virginia border, passed over the Panhandle section, and roared across southwestern Pennsylvania to Cumberland, Maryland, a distance of eighty miles. That storm killed forty-four people, injured more than 200, destroyed more than 200 homes, and inflicted major damage on approximately 500 other buildings, with an overall loss of more than $2,000,000.

These violent twisters are a typically American phenomenon. Together with hailstorms, they are the two outstanding atmospheric disasters liable to occur

without warning almost anywhere in the United States. According to the United States Weather Bureau, they are well-nigh peculiar to that part of our country east of the Rockies, and rarely occur in the Alleghenies or along the immediate Gulf or Atlantic Coasts. Their decided prevalence in the United States is because of a combination of factors found together in no other part of the world.

First, the great central valley between the Rockies and the Appalachians slopes gently to the south, and provides an unobstructed channel for the strong, moist, warm currents of air that blow up from the Gulf of Mexico on the front side of advancing storms. At the same time, an unimpeded track is provided for strong, dry, cold winds that blow at the rear of a passing storm from the north and west.

Second, it is a well-known fact that the towering, cumulus clouds of our common thunderstorms are caused by very strong rising, or updraft, currents. When these violent updrafts and the strong counter-currents combine—and such conditions arise frequently—we have encountered a mighty eddy, or whirlwind, which is exactly what a tornado is.

These vicious little whirlwinds average about 300 yards in diameter, although individual ones have been observed from only a few feet to more than a mile across. A study of about 1700 storms shows that the average path is about twelve miles in length. Here, again, there is great variation. A small, but very violent, tornado observed in Kansas on April 18, 1927, traversed a path only 100 feet in length. The great tri-State tornado, of March 18, 1925, laid waste a path nearly a mile wide and 219 miles long.

The forward speed rate of a tornado ranges from a few miles to nearly 150 miles per hour. On June 24, 1930, a storm was observed that moved forward at only five miles an hour. But on May 25, 1917, one was observed that drove along at the almost incredible velocity of 139 miles an hour. Both of these storms occurred in Kansas. There are a few records where a tornado has remained practically stationary over a period of several minutes—a sort of hovering.

A factor of great destructive power is the updraft, or suction, that accompanies these storms. From all evidence this must be 100 miles an hour or more. Buildings have been picked up from their foundations and lifted hundreds of feet into the air. Heavy metal and concrete objects have been tossed hundreds of feet as though composed of pulp or trash.

But the chief and most destructive characteristic is the whirling movement. This has been estimated at from 100 miles per hour, in the least destructive storms, to more than 500 miles per hour in the most violent ones. Indeed, some observers insist that the velocity is probably much higher than this. In hundreds of instances straws have been driven into trees, solid fence posts, and the weatherboards of buildings. Splinters, small twigs, pebbles, and other articles have been driven entirely through trees, boards, and metal sheets. Obviously, the velocity of the wind must be incredibly high to accomplish such feats.

U. S. WEATHER BUREAU PHOTOGRAPH

This photograph of a tornado at Paris, Tennessee, March 11, 1942, shows the similarity of twisters to the smoke of a moving locomotive. The likeness ends there. Every spot touched by the lower end of this cloud was swept clean. A path was cut several hundred feet wide and a dozen miles long.

The vortex of a tornado is marked by a pendent cloud, commonly called a "funnel" cloud. However, the funnel cloud is not so common. In the majority of instances, observers have described the cloud as resembling an immense elephant trunk, or an enormous rope. It has even been mistaken for smoke from a moving train.

The lower end of this cloud moves about in an erratic manner precisely like a rope dangling from a rapidly-moving vehicle. Wherever it comes into contact with the ground it destroys everything in its path.

The capricious hopping and zigzagging of this pendent cloud explains some of the bizarre freaks that accompany tornadoes. In one instance, the cloud seemed to rise and pass over a barn in its path, but descended in time to demolish all other farm buildings nearby. The house and an adjoining washhouse were entirely blown away, but several bee-hives standing on rather frail supports only a few feet back of the washhouse were undisturbed. At another time, the whirlwind passed between a barn and a house,

After the tornado of March 18, 1925, not a house was left tenantable in Griffin, Indiana. Fifty-five people out of a population of 350 were killed. The house at the left was carried for a considerable distance by the twister.

blowing the south half of the barn roof one way and the north half of the house roof in the opposite direction.

The most recent compilation reveals that nearly 4000 tornadoes have occurred in the United States during the past twenty-seven years. And, while they may occur at any time of the year, the spring months show a decided prevalence. The average is about three in each of the winter months. Then the average mounts to about twenty-five per month during the spring, with the climax occurring in May. During the summer months the average drops to about fifteen per month, with a further sharp decline to about five per month during the fall. The yearly average is about 145.

During the twenty-seven-year period (1916-1942) a property loss in excess of $330,000,000 has been sustained, and more than 6600 people have lost their lives. There is a wide variation from year to year in both property loss and fatalities. In 1925, nearly 800 deaths were attributed to tornadoes. In 1937, only twenty-nine deaths were reported. Property losses have ranged between $2,000,000 in 1916 to the staggering sum of more than $43,000,000 in 1927.

Tornadoes have been reported from every State in the Union except Nevada. The doubtful honor of being the greatest tornado state is shared by Kansas and Iowa. In the twenty-two-year period between 1916 and 1937, Iowa ranked first. But in the twenty-seven-year period mentioned before, Kansas again took the lead. These two States average fourteen or fifteen tornadoes per year. During the twenty-seven-year period, five other States—Texas, Arkansas, Oklahoma, Missouri, and Mississippi—had a yearly average of more than ten each.

Probably the most destructive single tornado in our history was the one that struck St. Louis, Missouri, September 29, 1927. Seventy-two persons lost their lives and approx-

(Continued on page 276)

U. S. WEATHER BUREAU PHOTOGRAPH

This street scene shows the devastation wrought by the tornado of June 28, 1924, at Lorain, Ohio. Damage totaling more than $11,000,000 was done, and 73 persons lost their lives. This was one of the most destructive twisters of which there is record in the United States.

L'Affaire Chipmunk

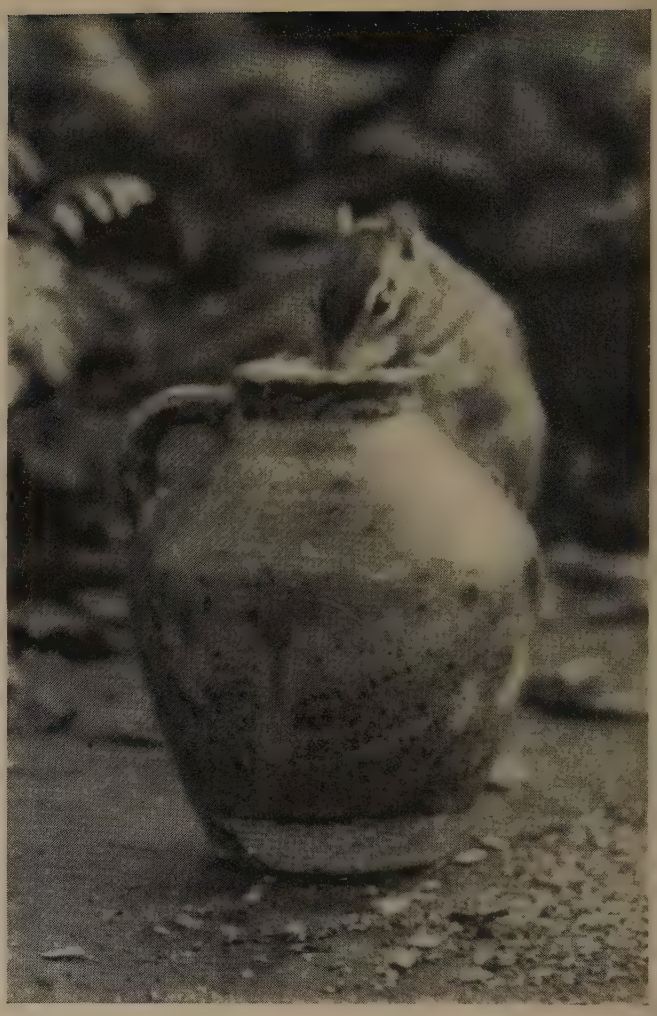
By HELEN CLARK PHILLIPS

FOR four years I have had the same pet chipmunk. In the beginning, when our relationship was mutually a wary one, I referred to the rodent as "it." But as soon as "it" was tame enough to sit upright upon the palm of my hand, the facts of life asserted themselves. Udders, obviously in working condition, were prominent. It was quite apparent that I was trafficking with a determined and fertile female.

Occasionally a friend, untutored in chipmunk differentiation, insults me by asking how I know that I am *en rapport* with the same chipmunk. As he nervously watches the bevy of *Tamias striatus* which cavort around our old stone walls and garden borders, he continues to look incredulous as I explain the individual mannerisms and temperament of the matriarch of our tribe. Mom Chip comes out of the same hole in the ground; she waits for me on the same stone; as I approach, she ducks into the wall, peering out of one crevice to make certain that I am not a weasel or a hawk; she comes to my hand from the same direction. Anyhow, I know her. She struts personality, as does no other chipmunk I have known. In March or April, when we open the house, Mom Chip is on hand immediately, with the same brazen assurance that she showed in November, just before she hibernated.

Once or twice a season she lets her crop of young follow her to the garden borders and to the feeding stone, which we call rodent rock. They number three, four or five and are more than half her size when I am first allowed to see them. As they have been taught to follow the leader, they come promptly to the stone and to my hand. Soon Mom realizes that her babies are competitors. She scolds and chases and nips. If a bold one insists upon returning, she leads him to a crevice deep in the wall, deposits enough seeds to keep him busy, then returns to demand my undivided attention. I hear him cracking and munching. The frantic mother, with no paregoric handy, has found a way to keep the brat quiet.

Usually there is one in every batch of young that is determined to keep in touch with me, a dependable source of fodder. This is difficult to manage, as Mom Chip is a jealous female. Her scolding reaches a higher pitch, and her nips become bites. Every summer I have three or four young chipmunks that are fairly tame, but it takes ingenuity to keep our meetings secret from the old matriarch. Sometimes we discover an hour when she is usually distant. After a few of these peaceful, clandestine get-togethers, she suspects something and appears unexpectedly. Then we change to a more distant rendezvous. Mom is too smart. She covers the whole chipmunk front and is soon filling her cheeks with the food I left for baby. My relationship with her young always remains a touch-and-go affair. One exception is in the making. Gus, so named because our acquaintance began in August, may have outsmarted his canny mother. He has dug his burrow not more than six feet away from the kitchen window. Although he still appears nervous at such a lack of privacy, the frequent goings and comings do keep Mom Chip away. Her burrow is some fifty yards distant, so Gus gets a lot of provender, if little tranquillity.



Mom Chip learns in a jiffy to find her food in new places.

Pop Chip seems to be but the accessory before the fact. Only twice have I seen a second adult chipmunk. Conscious of his brief, minor rôle, he makes a quick getaway the second I appear. Chipmunk society evidently is a matriarchy.

The IQ of a chipmunk must be very high. Mom Chip learns in a jiffy to find her food in new places—in a paper bag, in my pocket, in a jar or glass. Yet she prefers familiar routine. When she runs through the grass to meet me, she turns back, trying to lead

me to our customary feeding trough, the rock. If I insist, she will eventually come to my hand, in whatever foolish new place it may be located. For food, and for food only, will she change her ways. And for food she allows certain impudences on my part. She lets me tickle her white tummy, stroke her tail and count her toes for just as long a time as she is occupied in stuffing her pouches. The moment the supply is exhausted, or her cheek capacity has been reached, she is off.

Mom Chip is as stubborn as she is smart. She has persistent and rigid ideas about gardening. If you are an inflexible gardener, you may as well call the cat. My gardening is adaptable and I follow the whims of the boss gardener, Mrs. Chipmunk. When we thoughtlessly cut the tall grasses that concealed her hole, she was terrified, so terrified that she stayed away for several days. We are glad to forego tidiness in order to provide protection for her, and now the forest of stalks camouflages her entrances and exits. She plants barberries and dogwood berries with abandon, sometimes in well-chosen spots. I am really grateful for several of her landscaping projects. She uproots bulbs, with the exception of garlic and onions. After I replant flower bulbs three or four times, she usually lets them alone, having learned that the loose earth in that particular spot leads to no treasure of her liking. Occasionally I am forced to change the location of the bulbs. Near the rodent rock we always have a curious assortment of sproutings: whatever comes up from a mixture of wild bird seed, and many barberry and dogwood shoots. As yet I have not spotted a cherry life-saver bush. I only hope that I shall recognize the leaf, as many red circles have been planted.

After four years of trial and error, I find that chipmunks like the following menu: gooseberries, raspberries and strawberries, raisins, barberries, blueberries, dogwood berries, the seeds of the elm tree, Chinese lichee nuts and butternuts, when cracked, walnuts and hickory nuts, wild bird seed, sunflower seed, cracked corn, cherry life-savers, insects, and birds' eggs that are in low nests. They are thirsty creatures, often imbibing at the brook or at the bird bath.

A harsh critic, the chipmunk prefers the author's fodder to her art.

Sunflower seeds are her favorites. She has hoarded bushels in her burrow. Each seed measures about three-eighths of an inch and when she is undisturbed upon my well-stocked palm, she stows away in her two bulging cheeks from thirty to forty of these good-sized seeds. Every now and then she has an urge for fresh meat, and when a chipmunk has an urge it acts in a jiffy to satisfy the desire. Once, in a sentimental mood, I was watching her wash herself, face, ears, tail, like a cat. I was thinking how beautiful, how trim, how neat, how fleet. Suddenly there was a brief commotion. I was knocked out of sentimentality into harsh realism as I watched her devour the head of a grasshopper that was still kicking its objections. The subject of birds is more painful. Although I have never witnessed the sucking of birds' eggs or the enjoyment of succulent fledglings, I do know that the mortality of baby birds that are housed in low shrubs is much higher since the advent of the chipmunks.

Chipmunks are very articulate; in fact they are garrulous when in a rage. Now that I know their spirited *chip chip chip* call, I often follow it to discover the source of their alarm. Usually it is aimed at another chipmunk or squirrel, obviously outraging rodent etiquette, but once I found a young chipmunk trembling with fury, scolding a sleeping cat.

Despite my association with her sundry young, Mom Chip remains my favorite. Although I know that she has no sentimental attachment for me, she has more than a feeling of security in my faithful rôle of provider of provender. She shows unending curiosity in my two-footed, clumsy movements and she likes to have me around. Often, when many seeds are on the feeding stone, she lies down near them, waiting for me to come out. The second she hears me open the door, she scurries to gather the food. It would not look well for a chipmunk to be caught just waiting unindustriously for the approach of a human. Her favorite spot of waiting is on the corner of a stone wall where she can watch my doings inside the house. As I step out, she starts running, with that peculiar jerky fleetness, towards our rendezvous. When I cannot see her, (Continued on page 272)

Boogle Belts

Another Nature-Craft Article

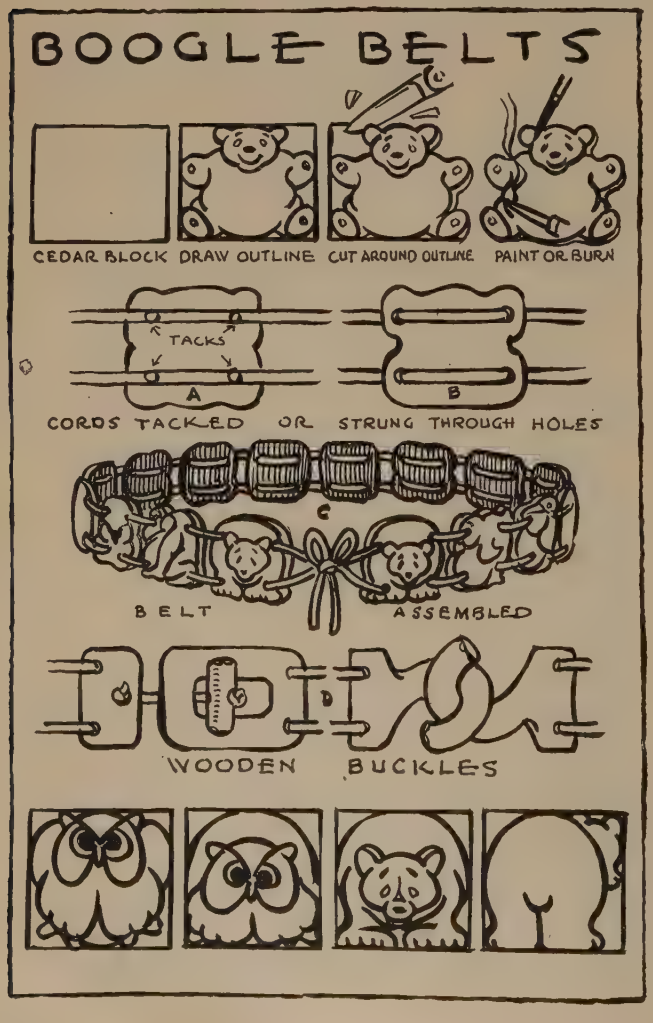
By ELLSWORTH JAEGER

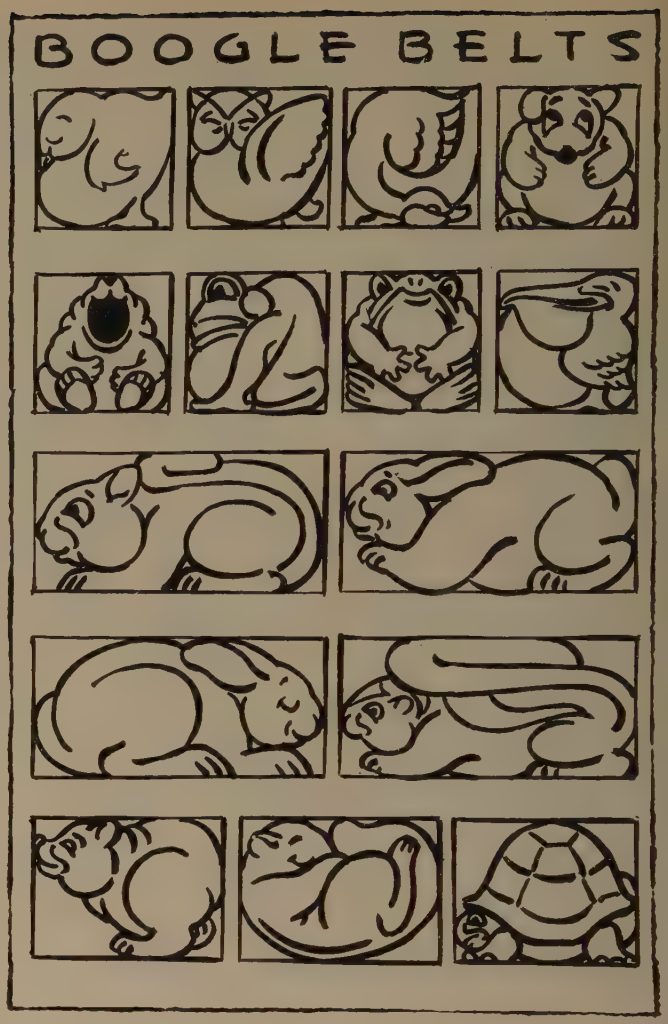
HAVE you heard about Boogle Belts? Or are they known to you as Jimbo or Boo Boo Belts? How would you like a Brew-in-Bear-Ring-Side Belt, or a Bellikan Belt? Or how about a Bik-Bik Belt, for example?

This "giggle jargon" is really superfluous, since this intriguing craft—for thinking hands to make—is most fascinating once hands and mind are applied to it. It is an excellent craft idea for camp, school, church or club group, and also offers an opportunity for sales, if good and careful work is put into it.

First go to the zoo, museum or woodlot to find models among the animal folk. The next step is to draw these in compact design with a minimum of projecting or sharp parts. Keep ears, legs and tails close to the bodies, so that the outline of the animal is roughly oval or round. After the designs are on paper, the following materials are needed.

To make a belt six or eight blocks of soft wood, preferably cedar, are required—more if the belt is for





a generous waistline. The blocks should be about two by three inches, and about one-quarter-inch thick. Sandpaper them smooth and trace the design on them. Then carefully cut away all wood around the outline.

The details inside the design may be painted in outline, or burned with a wood-burning set. If a beautiful wood is used, finish each unit of the belt by merely waxing or varnishing. However, if bright, colorful belts are wanted, use bright enamel or oil colors.

The units are made into a belt by tacking one or two thongs, or colored cords, to the back as shown in A. If one or two holes are bored, or burned, through each end, the blocks may be strung upon the thongs as in B. The completed belt will look like C, and is fastened together by tying a bow at the front. Simple wooden buckles may also be made, as in D. A number of animal and bird designs, and how their forms are adapted to this project, are shown in the illustrations.

These designs can be modeled in clay, if you are ceramic-minded, but these must, of course, be fired. A simple firing kiln may be made from a metal can with a good hot fire covering it for several hours after the clay objects have been placed on it.

Smaller copies of these designs may be made into necklaces, pendants, or lapel pins. If well made, these are selling material for school, church or troop fund.

The crater that is the central feature of Sunset Crater National Monument in Arizona. More than one thousand years ago a volcano blew the top from this 1000-foot hill, rimming the mouth of the crater with colored mineral deposits, mostly red. Today these gleam in the evening sun making a visit to the spot an unforgettable experience.

Sunset Crater

By JOYCE ROCKWOOD MUENCH

Photographs by Josef Muench

Arizona harbors in her bosom—well above the heart—a crater that was once a thing of fire and belching smoke, laden with stones and red-hot lava. Minerals, dragged up from the seething core within the earth, splattered on the mouth of the crater and remained there even after all activity within had ceased. That is why the great black cone of cinders is topped with red, yellow and green around its crest. The sinking sun lights it up and brings out the beauty of these birthmarks, and so the white man calls it the "Sunset Crater." The Hopi Indian calls it Polotsmo, the "red hill." Here dwell their benificent gods, and out of certain big crevasses comes the wind-god to blow everything before him—so says Hopi legend.

To the geologist, as well as the archeologist, there is much here to challenge the mind, for Sunset Crater is a pre-historic eruption that can be fairly close-dated. According to modern tree-ring methods of reading the past, the timbers found in some of the pit-houses were buried by volcanic ash about 885 A.D. It was not the first volcanic activity that we know took place in this area. The San Francisco Peaks are part of a broken volcanic cone. One whole wall was torn away in a mighty eruption, but there still remains the larger part of a great circle. Four peaks stand out from the plateau and can be seen for a long distance. Of these Humphrey (12,111) is the highest peak in Arizona. The other peaks are named Agassiz, Fremont, and

The view from the southern slopes of Sunset Crater looking toward the Tonto Rim. The timber increases in quality as it grows farther and farther from the cinder-strewn crater. The tree below seems to defy all Nature's laws as it maintains a foothold in a field of lava in the National Monument. Every line of its twisted trunk and limbs bespeaks the struggle for existence.

Doyle. The eruption in the San Franciscos occurred in an earlier period of time, and the great slopes are now covered with timber, and the volcanic cinders have merged with the soil.

Since far back, as far as even dim legends tell us, man has lived at the foot of the Nuva-tekia-Ovi—the snow mountains. Although the winters were severe and long, there was water. Land could be cultivated during the short growing period, and corn laid away. The countryside on the plateau about the mountains was desert. But always there were a few people living along the courses of the small streams, and there were occasional small oases where pit-houses might be found.

It was these early dwellers, perhaps ancestors of the present Hopis, who one day were terrified by seeing great clouds of smoke and fire come out of the earth. The ash fell over a wide area. The sun was blacked out and the earth trembled. Deep roars were heard. It must have seemed like the end of the earth. The frightened people gathered up their poor possessions and fled to beyond the pall of smoke. The town of Oraibi, sixty miles to the northeast, is believed to have seen the eruption.

In a few days the smoke cleared and only a wisp-like cloud was seen floating out of the top of an immense black cinder cone, created in these few days of noisy activity. The earth ceased trembling and when the sun went down those hardy natives who ventured back saw it turn the black cone to red.

It was not long before it was found that better crops could be grown in the cinder than had been possible before. Trees began to get a foothold in it, and flowers added their delicate charm to the landscape. A mulch had been laid down by the volcano. This held the moisture instead of letting it run off to the Little Colorado, as of old. And now a land rush began. Eight hundred square miles of land drew people from a large area. In the refuse piles of that day, and in the changing type of dwellings, we find the story of the immigration. The pit-houses gave way to stone huts. These in turn were replaced by large community dwellings, such as still stand at the nearby Wupatki National Monument. What a story might be written of the rise of this region—a boom started by a volcanic eruption! But its fall was just as swift. We can guess at the reasons. Overproduction wore out the soil. Crowded conditions, with lack of proper sanitation, caused epidemics. Soon the big houses were empty and the desert claimed the land for its own again.

Today, some 3000 acres have been set aside by the government to preserve

Cinder dunes in Sunset Crater National Monument as seen from the top of the crater. These dunes are bounded by some of the Bonita Lava Flow, which consists of coarser fragments of volcanic debris. There is a surprising amount of tree growth in this harsh land.

this colorful incident in geological history, and visitors may go to see one of the most recent workshops of Nature. They will find some unforgettable sights.

Not far from Flagstaff, the road leaves U. S. Highway No. 89 and turns into a cinder road. It goes through a pine forest that rises from black soil and that hardly clears enough to permit of a good view of the crater. The Bonita Lava Flow winds around like a great coiling snake at the foot of the crater. Quite different from the fine cinder, it is sharp, coarse, and there is a hollow ring to it when two pieces strike together. After the main eruption, this flow was caught in a basin of cones and piled up until it is hundreds of feet in depth, and there it cooled, appearing as though still in motion.

Beyond the lava flow, and nestled close to the mother crater, is a row of fumeroles or "spatter-cones." These mark a fault line where more lava pushed up around the parent. There is an ice cave here, too. From a hot day temperature one can drop in a few seconds to Stygian darkness and icy drips upon the walls.

Now, bulking large on the horizon, is the giant cinder cone itself, the great Sunset Crater. One takes about 45 minutes of strenuous climbing through the clinkers and fine cinders to reach its summit, a thousand feet up. From the summit there is a magnificent view of the San Francisco Peaks, with the Painted Desert to the northeast, and Tonto Plateau to the south.

The colorful mineral spring deposits are seen to be patches of considerable size that ring the crest. Great dunes of cinders have been whipped up by the wind and thrown into the same patterns that are familiar to us in sand dunes. The center of the cone is disappointingly only a hollow four hundred feet across, with perhaps fifty trees growing bravely.

Five minutes of breathless running and sliding are all that are needed for the descent from the top. The wind rises with the late afternoon and one remembers that somewhere about is the home of the god of the wind, and he must be stirring.

When the black shape of this mountain fades from the horizon and the rays of the sun no longer touch its colored brow, the traveler will still remember vividly "Polotsmo," the "Red Hill."

Some Grouse

By EDWARD A PREBLE

Photographs by Leo Jobin

Grouse of various species occur over most of the northern hemisphere. They include, in Eurasia, the black grouse, large birds with lyrate tails, of the Scandinavian countries, the capercailzie of northern Europe, also very large, with related species in the Caucasus, Altai, Turkestan and parts of Siberia and Kamchatka. There is also the hazel grouse, found in various forms from Scandinavia and Spain to Kamchatka and North China. This group is nearest the American ruffed grouse. All of them are birds of the woods.

Two other groups differ from the above in all particulars. These are the willow grouse and its relatives (really ptarmigan) of Arctic and sub-Arctic sections, and the sand-grouse, widely spread in deserts from northern Africa to central

The photographer has pictured a fine display as this male ruffed grouse struts on a sloping log, doubtless for its mate, below.

The male Richardson's grouse will sometimes attack the photographer who approaches too close to his sanctuary. Mr. Jobin states that a male, on one occasion, lit on his shoulder and picked at his ears and neck. When the bird found this was not enough, he tried to detain him by holding to his shoe-laces. Female on nest, above.

Asia, and even in Madascar and the Canary Islands. The sand grouse are highly migratory, and capable of swift sustained flight. So closely do they resemble the pigeons in several features and habits that they may be considered as intermediate between the grouse and pigeons.

On these pages are photographs of four species of American grouse, taken in southern British Columbia. All these species, and several others not here shown, were originally abundant in their several habitats, but with the advance of settlement, with towns and cities over the original haunts of the birds, they are fast disappearing, and it is evident that several species cannot longer be pursued as game. No species, however swift, can contend with the shot from modern guns, wielded by armies of gunners with thousands of new recruits each year. A modern

The sharp-tailed grouse is one of the most distinctive of the North American grouse, having the sexes alike, the upper parts white-spotted, and the lower parts with arrow-shaped markings. Here are shown two adults, a female on her nest and a brood of newly-hatched young, with one egg still unhatched. The picture was taken near Whisky Creek, southern British Columbia, in late May.

innovation that is particularly deadly is the opening of seasons in August and early September, when the young birds, although admittedly toothsome, are flying so slowly and helplessly that the whole brood may be easily wiped out. In many places each brood has been marked down beforehand by the hunters, and few survive the opening day.

The blue or dusky grouse, including the Richardson's grouse, *Dendragapus obscurus richardsoni*, are western species ranging mainly in the mountains from middle California to southern Alaska, east to the mountains bordering the Mackenzie River in latitude 62°, and south to

Franklin's grouse is the western representative of the eastern spruce grouse, and the two intergrade in central British Columbia. The female, left, has the breast barred, instead of solid black.

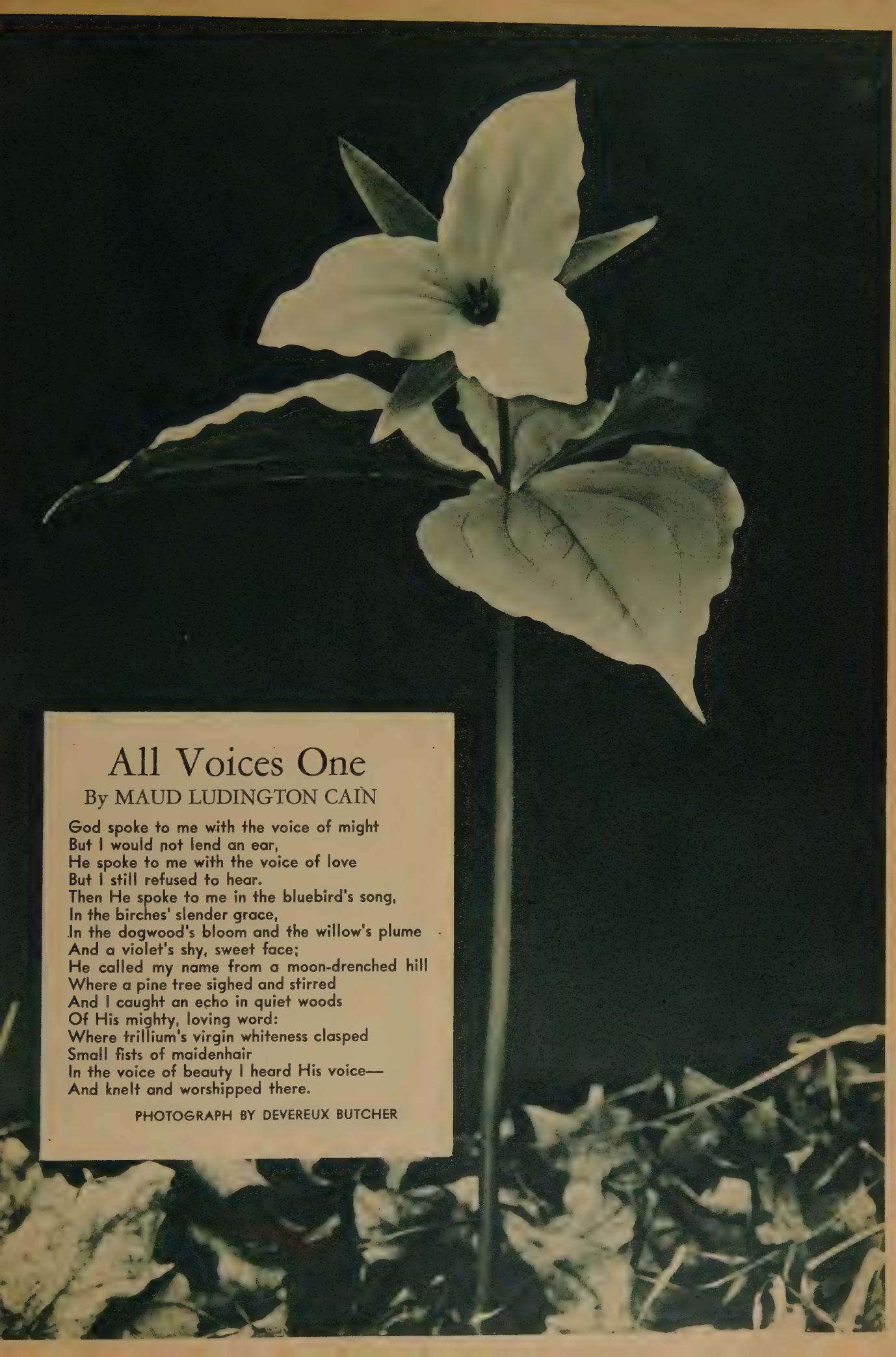
Colorado. Here it ranges over the middle altitudes to timberline. The male of this species neither drums like the ruffed grouse, nor dances like the prairie chicken, but it has a sort of hoot that may be heard far away. When uttered from the ground it is generally followed by a sudden fluttering demonstration sometimes audible for a quarter of a mile.

The ruffed grouse, *Bonasa umbellus*, inhabits North America from the southern shores of Hudson Bay and the lower Mackenzie in Canada, and the upper Yukon in Alaska, south to the northern United States to northern California, Montana, Missouri and the Appalachian region south to Tennessee. It is generally found in the valleys and more open deciduous woods below the zone where conifers predominate, hence its common name of willow grouse. It is best known from its drumming performance, by which the males attract the females in the mating season. There are many races.

The sharp-tailed grouse, *Pedioecetes phasianellus*, including several races, lives in the more open areas within the wooded country, in Canada from near the limit of trees in the central sub-Arctic to and beyond the United States' border in the West, and east to southern Hudson Bay and over much of Ontario. It is the most migratory of all the grouse here shown, and, unfortunately (or fortunately), is not suited for artificial stocking purposes, although a few states still ignore this fact. When taken out of its natural habitat, however, it almost invariably disappears "without trace" in its first autumn.

In its range in southern Canada it is called "prairie chicken", partly because of the extirpation of the latter, or merely from confusion of the two. The sharptail is considered by many to have the most toothsome and nourishing flesh of all the Canadian grouse. It is seldom shot otherwise than on the wing, and if missed is likely to fly so far that it gains safety.

The spruce or Canada grouse, *Canachites canadensis*, occupies most of the eastern part of the great transcontinental evergreen forest south from the treeless area of Canada to northern Maine, New Hampshire and Vermont, and grades in eastern British Columbia into the western race, *C.c.franklini*, the race here pictured. This is the only grouse able to subsist entirely on pine or spruce leaves, and therefore is dependent only on coniferous trees. In winter this diet is reflected in the piny taste of its flesh, which therefore needs no poultry dressing. Naturally the birds are very tame, that is—fearless—and this has given rise to the term "fool hen". Sometimes this tameness leads to their not being noticed by the woodsman. More frequently their trustful nature is considered to merit death.

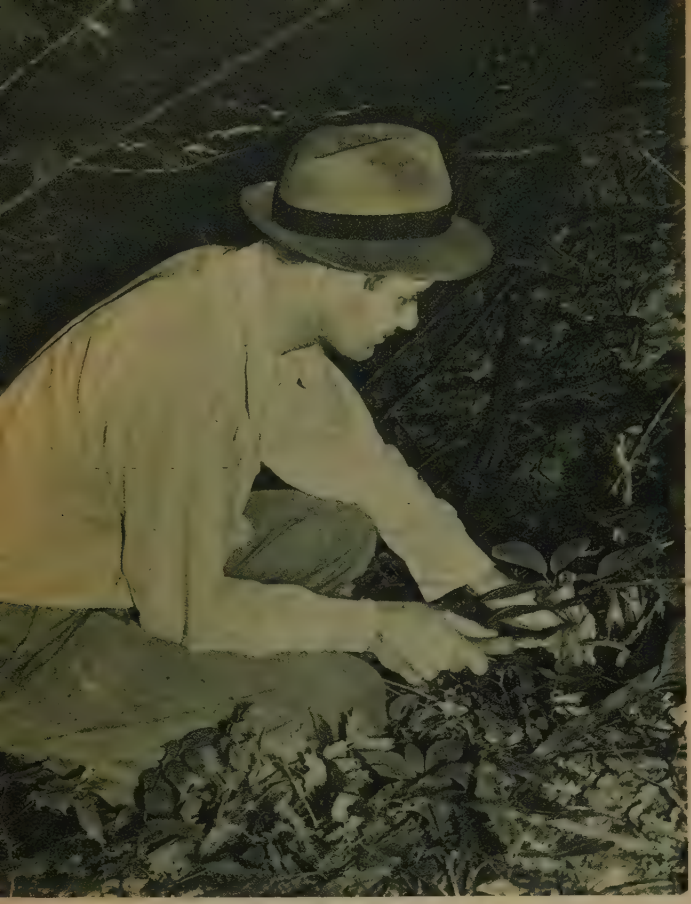


All Voices One

By MAUD LUDINGTON CAIN

God spoke to me with the voice of might
But I would not lend an ear,
He spoke to me with the voice of love
But I still refused to hear.
Then He spoke to me in the bluebird's song,
In the birches' slender grace,
In the dogwood's bloom and the willow's plume
And a violet's shy, sweet face;
He called my name from a moon-drenched hill
Where a pine tree sighed and stirred
And I caught an echo in quiet woods
Of His mighty, loving word:
Where trillium's virgin whiteness clasped
Small fists of maidenhair
In the voice of beauty I heard His voice—
And knelt and worshipped there.

PHOTOGRAPH BY DEVEREUX BUTCHER



Digging a ginseng root found in dense shade and maple underbrush. They usually do not thrive in open or damp ground, although are occasionally found on low ground, where seeds were probably dropped by birds.

This American ginseng plant, *Panax quinquefolium,* is about ten years old. The berries in the center are bright red when ripe. They form in the fall from a cluster of small white flowers that bloomed in the summer.

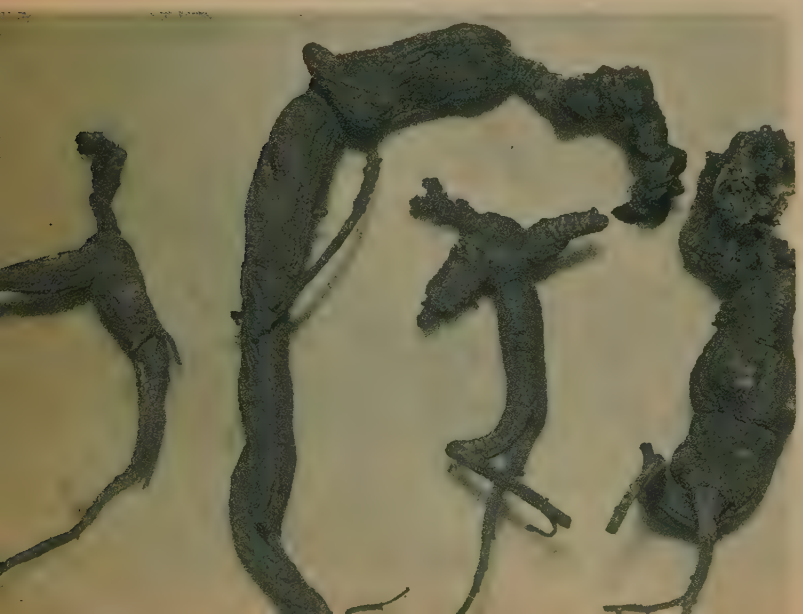
What Good is Ginseng?

By A. C. PARSONS

The answer to the question in the title is—nothing, except as an interesting wild plant left in the wild. For centuries the Chinese have regarded the root of this plant as a cure-all, effective for the treatment of mental and physical exhaustion, for strengthening the stomach, restoring youth, reviving the fainting, and prolonging life. In the face of this imposing array of medicinal virtues, the U. S. Pharmacopeia says that the root has no therapeutic value whatsoever.

Chinese belief, however, has created an active demand for the roots for export. Thus the ginseng plants have been widely sought and ruthlessly dug up, bringing it nearly everywhere to the point of extreme scarcity. This all started when a Jesuit missionary in China wrote to a colleague in Quebec in 1711. He described the plant and its supposed virtues and suggested that it might grow in the region of Quebec. It was found there the following year, by the aid of careful drawings the missionary sent. Indians were sent out to hunt the herb and a new industry was started.

Demand for ginseng sent plant hunters in the United States looking for it, and it was found from Quebec to Georgia, and as far west as Illinois and Missouri. Usually growing in dry, rich soil in high ground in hardwood timber, it is, when mature, a plant standing from twelve to eighteen inches. There are usually three or four forks from the main stalk, each with five leaves. The root is the valued part, and man-shaped roots are the most prized. The name ginseng, in fact, means "figure-of-a-man."



It is the root of the ginseng that is much sought, for the Chinese hold it to have medicinal value, although no such quality is recognized by the medical profession. Leaf scars in the "neck" of the root in the center show it to be twenty-eight years old. It had a weight of twelve ounces when wet and three ounces when dry. Those roots that take the shape of man are considered the most valuable by those who place faith in ginseng. Wild roots are more sought because they take more fantastic shapes than cultivated ones. Roots must be at least seven years old to be worth digging.

Thoughts on Falconry

★

In our August-September issue of 1944 we carried a brief note in which we said: "An amazing amount of romantic fiddle-faddle has been conjured up to make the hobby of falconry acceptable. It even parades under the banner of conservation by the use of some of the neatest sophistry we have encountered. Actually this so-called sport has been costly in the lives of much-persecuted hawks, and threatens to wipe out the duck hawk, the peregrine of the falconer. It also causes the death of many protected song and insectivorous birds. And the technical methods of the falconer are something that the humane societies should get aroused about, but do not."

This comment was made in connection with announcement of a pamphlet entitled "The Duck Hawk and the Falconers," published by the Emergency Conservation Committee. It was calculated to draw fire from the falconers—and it did. One of the protestants was Dr. Walter R. Spofford of the Vanderbilt University School of Medicine. Through a considerable and interesting exchange of correspondence we discovered Dr. Spofford to be a sincere conservationist, a deep student of birds, aware of faults into which falconry has fallen, and with ideas of what should be done.

Our statement was quite sweeping and apparently unfair to the more conscientious and thoughtful falconers. Our reference to "romantic fiddle-faddle," however, we feel is justified by some of the published articles dramatizing falconry, and stimulating young people to undertake the hobby, despite little knowledge of what they were undertaking, and with resultant loss of birds. Falconry as a part of conservation still seems to us a bit incongruous, but it is nevertheless true that a body of enlightened and militant falconers can undoubtedly contribute to hawk conservation by virtue of their interest in and solicitude for hawks. The cost in song and insectivorous birds through falconry appears debatable, and we might find it more difficult to defend our view of small bird destruction than the falconer would his. As to the humane aspect, American falconers appear largely to adhere to a code that is humane, and the hood used may look more uncomfortable than it actually is. We are afraid that our comment on this point arises from our fundamental—and frankly sentimental—distaste for seeing any wild animal in captivity, whether it is a chained falcon or a giraffe in the zoo.

There being at least two sides to every question, and freedom of speech being the freedom we cherish particularly, we welcomed Dr. Spofford's offer to express his views on falconry and conservation in an article. This discussion appears on the succeeding four pages.

Dr. Spofford is an exponent of the highest ideals in falconry, and his association is apparently largely with those who share his viewpoint. He has studied the subject of the impact of the falconer on existing eyries of the peregrine, and arrived at the conviction that it represents no serious threat to the bird. If all falconers, both experienced and tyros, shared Dr. Spofford's views of falconry, this conclusion might well be correct. Undoubtedly existing peregrines suffer more from the hawk shooters than the falconers. Nevertheless, promotion of the hobby—or art, as Dr. Spofford prefers to call it—of falconry constitutes a serious potential threat through the thoughtless depredations of beginners stimulated by publicity.

To meet this and other conditions Dr. Spofford proposes the licensing of falconers on the basis of competence, and other regulations of the practice of this hobby. These proposals represent admirable goals, which, if they could be put into effect and enforced nationally, would certainly remove any reasonable objection to falconry. We doubt, however, that his views are shared by all, or perhaps, even, a majority of his colleagues, which might make his aims difficult of achievement. Also legislative problems would be complicated, although perhaps not insurmountable. However, the goals he proposes are desirable from several standpoints.

With Dr. Spofford's desire that the peregrine and prairie falcons be protected by Federal law we are in the heartiest accord. However, we consider such a consummation as well-nigh hopeless, as all the hawks and owls, as well as several other groups, were omitted from those listed in the Migratory Bird Treaty Act, since their inclusion almost certainly would have made impossible its passage. This fact limits all such groups to State protection. A few States, it is true, have given the peregrine and certain other hawks "paper" protection, and conservationists are hopeful that such movements may be extended. However, prejudices and hatreds against all such creatures have been so lasting and bitter that progress is very slow.

We are inclined to feel that Dr. Spofford is correct in his assertion that falconers can and do contribute to this worthy movement. Perhaps we can afford to trade a few young peregrines a year in return for their active support of protection of all hawks. In any event, we bespeak a careful reading of the article on "Falconry and Conservation."

Falconry and Conservation

By WALTER R. SPOFFORD

★

For editorial comment, see discussion of the subject of falconry and conservation on the preceding page.

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Portrait of a North American peregrine falcon, improperly and confusingly called a "duck hawk." A rare bird, partly because of its habitat demands, its use in the art of falconry is a matter of importance.

PHOTOGRAPH BY HOMER F. SNOW

ALTHOUGH falconry is one of the most ancient of recorded arts, in America the falconer is a newcomer among a host of other wildlife admirers. Interest in hawks as other than vermin received a great impetus with the publication of Fisher's *Hawks and Owls of the United States,* but it is only in the last decade that an esthetic as well as an economic appreciation of raptores has found large support. Interest in falconry in America increased after Fuertes published his now classic article in 1920, and spectacular publicity has now brought it wide attention. While most falconers are interested in hawk conservation (there are a few important exceptions), there is considerable difference of opinion concerning the effects of falconry on the populations of some rare raptores.

Recently it has been charged that falconry is inimical to the conservation of both hawks and small birds, and it is specifically claimed that the falconer threatens the admittedly rare peregrine falcon with extinction. Cases are cited wherein young falconers have shown a careless disregard for the rights of others in violating sanctuaries to secure young falcons. Not only, it is claimed, are falconry and conservation incompatible, but the falconer's methods are inhumane. The basis for this latter charge is the fact that in India the hawk's eyelid is "seeled" or closed by a fine thread in the early part of its training. This practice should be opposed by American falconers.

Falconry, in brief, consists in taming wild hawks and falcons, of training them to fly to fist or lure (an imitation "bird" of leather and feathers, swung by a cord) and finally flying them on live prey. During early training the falcon wears a hood to prevent her from becoming frightened, just as a horse wears a "blinder" in traffic.

Although anyone who trains hawks is considered a falconer in America, most of them are more nearly "pet-keepers" using the methods of falconry. Certainly less than a dozen (and the writer is not one of these) can train falcons that consistently take wild game. It is unlikely that wild birds taken by falcons will ever become a source of concern to conservation. Nine out of ten falcons are flown almost exclusively at domestic pigeons, and it is then almost impossible to fly them successfully at anything else. Contrary to one writer, falcons do fly to a "mechanical rabbit," and consistently so, the latter being in this case the familiar lure. However, there is no reason to doubt that falcons can be flown with measurable success in

PHOTOGRAPH BY THE AUTHOR

"Tundra", a migrant Arctic peregrine falcon, shortly after capture, in her first-year plumage of brown and buffy white. Many of these birds are passagers, coming from the far north in migration, and a few are taken by falconers.

PHOTOGRAPH BY THE AUTHOR

"Tundra" after her first molt. Her plumage is blue above, black and white below. Falcons like this can be flown with success only in open country, and the Cooper's hawk is a far better bird for the eastern American falconer.

the open country of the Dakotas, at such birds as the Chinese pheasant, which there abounds. There is no region east of the Mississippi where the falcon, bird of the open, can be flown with any measure of success. Not so the hawks, of course, and it is these latter birds that should be used by eastern falconers. Of course, there are many falconers who would rather enjoy a falcon stooping to the lure than to take real game with a hawk, and the writer is one of the latter.

Serious conservationists do not question the birds taken by falcons, but the rare falcons taken by falconers! However, the statements made by Mrs. C. N. Edge, that the peregrine—or "duck hawk"—is in danger of extermination by falconers, will not bear investigation. Furthermore, only a minority of falconers have—or ever will have—a peregrine falcon, for, while this bird is highly suitable to the open moors of Scotland, it is equally unsuited to the closed terrain of eastern America. Continental and English literature eulogizing the peregrine has had an unfortunate influence on Americans, and mature falconers realize that it is the true hawks (accipiters), not the falcons, that are most desirable for real falconry in eastern America. However, it is the peregrine falcon that is the chief concern of conservationists and the following paragraphs are devoted primarily to this species.

Although most of the facts presented in this account are to be found in the literature listed at the end, the present treatment is the writer's responsibility. To avoid confusion it should be pointed out that the term "duck hawk" is an American substitute for "peregrine falcon,"—which Alexander Wilson considered unsuitable because he thought that American birds were non-migratory! As we now know, American and Eurasian peregrines contain both migratory and non-migratory populations. It cannot be too strongly urged that the term "duck hawk" be abandoned, both in the interests of accuracy and as a conservation measure.

The peregrine falcon in America breeds from Greenland, the inland Arctic and Alaska, south to Georgia, Louisiana and Mexico. The Arctic populations are highly migratory, while the southern groups are permanently resident. This extensive distribution is represented by a thinly-scattered system of single breeding units, or "eyries." The rarity of the peregrine is not due only to any sort of predation, such as shooting, egg-collecting, or falconry, but is largely because of this falcon's specialized requirements for

PHOTOGRAPH BY THE AUTHOR

This peregrine eyrie is less than a mile from the heart of a city. A great many such eyries are in danger of extinction and need every possible protection from civilization and development.

breeding cover and adequate food supply. In New York City, the food supply—domestic pigeons—is high, and, consequently, the available breeding cover is nearly saturated, one pair, in 1943, finding marginal and hence inadequate cover on the roof of the St. Regis Hotel. "Cover" is an inaccessibility factor probably represented in the peregrine by a combination of height of cliff and remoteness of situation. While most successful local eyries are situated on high cliffs, Mr. Edward A. Preble, in 1904, found them along the Mackenzie River nesting on sloping clay banks. In Finland, according to Hartling, they nest on the open moors, and, in Arctic Russia, on the tundra. Here Buturlin states that the peregrine so industriously defends her "eyrie" against sea-eagle, gull and arctic fox that *ducks and shorebirds (duck hunters please note!) nest near the falcon for protection!* Needless to say, the ducks and shorebirds walk to and from their nests!

PHOTOGRAPH BY THE AUTHOR

"Narsa," a gyrfalcon taken from a nest in southern Greenland by Col. R. Luff Meredith. Now nearly four years old, hot Tennessee summers do not seem to affect her. Emperor Frederick II preferred these northern falcons for use in hot and dry southern Italy.

In Tennessee, breeding cover of the finest sort abounds in the cliff-walled gorges of the Cumberland Plateau, but the flying food supply is at a minimum, and the peregrine population is very thin per mile of escarpment. It is quite possible that here, city growth, with its attendant increase of the domestic pigeon populations, will result in a more extensive use of cover by the falcon in a future generation. Interestingly enough, the effectiveness of cover in cliff-nesting birds is not uniform. The Cumberland escarpments formerly harbored the raven, the golden eagle, and the peregrine falcon in proximity, as well as red-tailed buzzard, American kestrel, turkey vulture, and great-horned owl. Cover became ineffective for the raven about 1910, and for the eagle in the 1930's. The others remain. In Pennsylvania the eagle is gone, but the raven and falcon remain as breeding birds.

The American representative of the kestrel, miscalled "sparrow" hawk in this country, is the best "first bird" for the novice falconer.

PHOTOGRAPH BY HOMER F. SNOW

While predation probably plays a minor role in regard to the peregrine population as a whole, the fate of individual eyries is another matter. Many of our Appalachian sites are easily accessible, particularly along river bluffs, and many already have succumbed to farmers and gunners, and to other effects of civilization, not least among which is the picnicker, whose presence prevents the falcon from incubating her eggs. Many falcon eyries are close to cities and need every precaution to prevent their extinction. Other eyries of "temporary" or marginal nature offer so little cover that falcons easily abandon them. These all should be strict sanctuaries.

Some eyries are already within sanctuaries, and there is no possible excuse for their abuse by falconers or egg-collectors. The few falconers who do offend are a source of considerable embarrassment to the more conscientious majority. The privileges of falconry should be denied those who cannot abide by both the law and good sportsmanship.

Vulnerable as are many sites, however, it should be pointed out that first class eyries are remarkably resistent to the encroachments of civilization, and where such eyries do retain some semblance of cover, the falcons remain even under extreme conditions. For several recorded decades there have been six eyries along the lower Hudson River. Of these, the Fort Lee site was unable to compete with the 125th Street Ferry, but the others are all going concerns, in spite of the fact that a highway was built across the cliffs below two eyries and just above a third! At one Delaware River site the pair suffered highway construction and now use a ledge only a few yards above passing traffic. It is certainly unfortunate that no record was kept during those trying months of dynamite and bulldozer!

On the Hudson, besides the tradition-hallowed older eyries, there are now two new sites in abandoned quarries, and two other quarries have been used at least once. At two of the older eyries the falcons no longer lay any eggs, in spite of persistent "ledging" and "scraping" by the tiercel (male). However, these and many other examples indicate that extreme statements about the imminent extinction of the peregrine are not based upon sound observation.

Wholly pertinent should be the question concerning the number of falcons removed from the population each year, either as nestlings or as migrating passagers. Obviously, loss of a nestling is not nearly so serious as the loss of a breeding adult, as by no means do all birds that hatch reach the breeding stock. Some eyries are not used every year; at others no eggs are laid; the eggs are removed from some; frequently only one or two hatch, and later predation may remove the remaining young. Twenty-three eyries in the lower New York area averaged only one eyas (nestling) per nest per year in a two-year study. Furthermore, most falcons that get shot, or get into other trouble, do so during their first year. The proportion of young hatched each year that is finally absorbed by the breeding population is undoubtedly small. And other factors affect the rate of absorption. The relatively fixed amount of breeding cover means that any increase of potential breeders may be forced to use inadequate cover in all areas where the population is cover-limited. It should seem obvious that there is no one-to-one ratio between a nestling on a ledge and a breeding adult. The recent account of Dr. Bond citing the disappearance of young birds from the American kestrel population should be consulted for an interesting (Continued on page 274)

Park mallards decoy many kinds of waterfowl for the enjoyment of the Minneapolis bird lovers when the spring series of walks take them into an area remarkable for its bird life.

If you go afield to seek the birds,
Spring bids you to—

Listen! Stop! Look!

Photographs by the Author

By LULU MAY ALER

EVEN as we step from the car about nine o'clock April first, the voice of a song sparrow bids us pause and gaze on the opening soloist of our club's annual bird festival, our series of nine weekly walks in a city park. Although ice still coats the lake and snowdrifts patch the glen, many heralds of spring sing lustily. Beneath a ringing redwing chorus in the sunglow of awakened willows, tiny tinkles, twitters, and trills halt us for tree sparrows and juncos in weatherbeaten brush. From a nearby field floats the sweet lay of the eastern meadowlark, and, often, the ecstatic rhapsody of his western kinsman. We near the beach cautiously, for there may be killdeers on the sand, and crows and gulls on the ice sheet's melting edge. One year, ring-necked ducks climaxed the striking black-and-white scene.

Fleeing the bitter north wind, we turn to the glen. Robins and a heavenly bluebird carol on the green slope to our left as we enter the hairpin trail that skirts the Native Plant Reserve and emerges near Birch Pond—a little rush-girt, hill-encircled gem only a five-minute hike from the lake by road, but several hours' listen-stop-look by path. Purple finches and goldfinches warble exuberantly atop birches in the bog to our right; a fox sparrow's glorious aria holds us spellbound.

Around the bend, golden-crowned kinglets whisper *See! See! See!*, and show us sparks of gold in the dark hillside evergreens, with possibly a ruby-crown among them. Mingling with the finch chorus here are vivacious chickadees, songful cardinals, and all our other permanent guardians of park vegetation and human morale. Although still patronizing their winter cafeteria, they are ready for change from daily to emergency service. A chickadee whistles sweetly to his mate between grateful *dee-dee-dee's;* they snatch a few seeds and are gone. Downy woodpecker interrupts his drummed love song only long enough for a snatch at the suet.

On to Birch Pond and back by road to the carline, we find more migrants, more bits of the mysterious global phenomenon that has from time immemorial fired the imagination of man. Our chilled but eager fingers check our morning's list—around twenty-five species on our first walk, including some whose Old World relatives are likewise swinging north from wintering to breeding places. We shall discover many more little travelers whose hereditary routes and appointed time bring them to our Minneapolis bird walks.

A week later we proudly check some thirty-five species—exciting!—but only part of the story, for the chorus swells with greater numbers of those noted before. Out among spongy floes a loon flaps icy cascades over his crazily-rolling body from first one side then the other; a kingfisher rattles noisily

back and forth between two lookouts; great blue herons course silently north overhead. The glen's poplar catkins lure gorgeous sapsuckers and fluttering myrtle warblers. Now we detour through a densely wooded tributary ravine, the Reserve's wildflower garden. Where the first snow trilliums peep through the black mold, we meet the serene gaze of a hermit thrush; one memorable spring he sang a bit, presaging his great solos up North.

By mid-April we find our park mallards out of winter quarters; and with them visiting scaups—and perhaps blue-winged teals or shovellers. Skirmishing tree swallows contest for a nesting-box on an offshore post; below them a pied-billed grebe dives incessantly. Once, high above us, two turkey vultures soared on set, upward-bent wings, then sailed northward out of sight. And once, as we tiptoed toward the feeding-station to glimpse sweetly-calling bob-whites, we spied a woodcock doing a springy jig on each foot with each deliberate step as he probed the mire—while another lurked near—such ludicrous behavior for a famed sky-dancer! Here another time we saw a bouncing brown leaf become a winter wren, usually chary of public appearance. We list around forty species on this third walk.

Our fourth often provides our most thrilling sky movies. The airway teems with great fliers—mostly hawks, especially broadwings. One such flight across Birch Pond's dome included a spectacular combat—two hawks careening and clashing wings constantly as they moved along with their gracefully wheeling comrades. On another occasion we saw the broadwings, with a few red-tailed, marsh, and sparrow hawks, over the hills; and then several hundred cormorants circling over the lake; as the latter strung out to the north, a red-shouldered hawk soared in their wake, followed in turn by an osprey.

Life flourishes more abundantly everywhere—more ducks and gulls on the water, possibly an American bittern or a green heron winging across, spotted sandpipers or lesser yellow-legs alongshore, and countless choristers in the glen, where marsh marigolds weave their carpet of gold toward the white birches and red-blossoming swamp maples. One year, while watching a broad-wing hunched on a limb, we discovered above him the only tufted titmouse ever to grace our records. Having brought our day's list to the expected forty-five with such an unexpected climax, he followed a chickadee over the hill, shouting *Me-too! Me-too!*

On our fifth walk, near May Day, we generally score between fifty and sixty. Expectancy runs high. The composition of the chorus has changed considerably in a month; ardently-fluting ruby-crowned kinglets and tremulous white-throated sparrows have succeeded golden-crowns and fox sparrows; a medley-making brown thrasher punctuates a treetop.

Our best luck now comes with a biting cold snap that detains most fliers. On one such morning, when we netted fifty-seven species, black-capped common terns topped the beach posts, all facing the dark, white-capped lake, sharply outlined against the soft mistiness of greening tamarack and willow. Across the lake, snowy gull battalions stood fronting windward up the emerald golf course.

At the glen trail bend we met a great throng of white-throats dashing down through the underbrush, singing and feeding as they came—and with them, a red-eyed towhee and a black-and-white warbler. Soon they had passed, a celestial choir surging on under the spell of powerful impulses. We shivered to the Curator's office past hesitant May-apple umbrellas and tightly-veiled spring beauties; but as we warmed our hands over the stove, confident phoebes rushed building operations on a shelf under the eaves. Returning to the bend, we found the wind-rebuffed throng (towhee and warbler included) trooping as furiously back into this hospitable haven as they had earlier raced lakeward.

Myriad swallows swirled low over a slough farther on, while out of bordering grasses popped innumerable myrtles—all snatching desperately at life-sustaining insects. Yet, from the woods beyond, a whip-poor-will whistled a dozen ringing reminders that spring eventually triumphs, if we are patient.

Birch Pond is a little rush-girt, hill-encircled gem and a haven for many birds. Photographed here in April, it is still waiting the full beauty of its surrounding birch trees.

Held enthralled long past noon, we bring lunch hereafter. Even though our sixth walk continues till midafternoon, we do well to check two-thirds of the hundred species likely to be represented. We long to be in a dozen places at once. One windy hour on camp stools among swamp bushes revealed an entrancing pageant staged by forty species. Elusive Virginia rails grunting weirdly and quaint soras whistling down the scale skulked through near reeds. Louisiana and Grinnell's water-thrushes teetered daintily about; yellow warblers mounted bush tips to puff red-striped golden vests with song; masked northern yellow-throats meandered past, chanting witchery themes; and four other warbler kin flitted by. Resplendent Baltimore orioles and rose-breasted grosbeaks joined the hosts longer sheltered here, while crackling chimney swifts and raucous black terns arrived overhead. A panoramic spectacle, indeed!

Another year, a misty hour on a hillside disclosed a fascinating ballet. In a lacy oak-crown setting, scores of tail-flicking palm warblers, with a few myrtles, orange-crowns, and others, danced to the white-throats' harmonious round wafted up from the bog. Suddenly, out from a leafing bush, darted the star, a tiny green-garbed ruby-throat, flashing his fiery brooch with each whirl, the earliest hummingbird we had ever seen. Then a magnificent white-crowned sparrow came to the fore of his brush opera box and stood watching with the dignity of a noble patron.

That day brimmed with events. As we reveled in the sight of three kinds of thrushes making the season's bow together under the glen's five-century-old elm, a dreamy, drawling black-throated green warbler lured us up the bank; then a clear-voiced blue-headed vireo led us on to the rim. Luckily we substituted the circling hilltop path for the valley trail, for a rare blue-gray gnatcatcher pair frisked through the oaks there, flirting black-and-white fans.

Mid-May usually transforms our seventh walk into a dizzy whirl as we vainly try to focus binoculars on individual will-o'-the-wisps in the warbler hordes dashing through well-leafed treetops. Having pirouetted past the beach and into the glen, we drop down on the natural grandstand facing the Reserve. Shortly, the verdant fringe opposite livens with bits of rainbow passing at comfortable eye level. The bordering path becomes a promenade for thrushes and sparrows and, in contrast with these hopping contingents, little ovenbirds strolling demurely along. Here we generally add brilliant scarlet tanagers and indigo buntings, mewing catbirds, and various flycatchers. But soon intriguing notes above start us whirling again!

One peak day we boasted ninety-three species. We had a cloudy morning, misty afternoon, almost freezing temperature. A near-gale whipped from the north. After a forenoon in the glen with a kaleidoscopic array of migrants piling thrill on thrill, we fortified ourselves with lunch and ventured around the lake to a conifer-clad ridge rising northward from a meadow. Huddled under an isolated spruce, a rod from the teeming woods, we exulted in the top high-light of warbler-time. Jutting out from the gay front line, a tall Christmas tree twinkled with colorful lights; never had Blackburnians, magnolias, redstarts, the chestnut-sided, bay-breasted, and other variegated mites flashed so vividly as against the dark evergreens. Even Tennessees, usually so gray up against the sky, displayed lovely yellowish-green backs. A brave Cape May quit sheltered pines for a cold spring bath, while a short-billed marsh wren furnished encouraging music. And, rare treat—a field sparrow trilled bewitching love songs with his appealing all-summer sweetness but with rapturous variations in time and pitch.

Sometimes both seventh and eighth walks catch tumultuous waves, but one year we missed them. Our seventh ferreted out only eighty species. Our eighth, on a beautiful, sunny day with the mercury zooming into the eighties, struck a vacuum between two great waves. With scarcely a migrant in evidence, we lazied through the garden drinking in the beauty of varied trillium, violet, and other flower masses in their prime. Then we lunched above Birch Pond and feasted our eyes on the evanescent, pastel loveliness of the wooded hills. The exquisite green of birches and the pink haze of oaks, made of delicate velvet bits more like flowers than leaves. We had missed one of spring's miracles but caught another!

Although our ninth walk, near Decoration Day, rarely finds more than two or three warblers left, a backward spring detained a dozen. These were leisurely stragglers viewed (Continued on page 272)

Migration

By MARY O'CONNOR

The reaching banks were drenched with swallows' cheeping;
A flock of feathered immigrants had stayed
Throughout night's drowsy pulling of her shade;
Dawn's pearly eyes beheld the whole flock sleeping;
One must have giggled, for a sudden peeping
Convulsed the birds that heard the chirp one made;
Like recess when chit-chatting children played
They whispered of the plans within their keeping.

With all wee batteries charged for long days' flying
They perched at each clay doorway, scanned the sky;
The living wall commenced to move or vibrate;
Five hundred tiny aviators, drying
Their dew-tipped wings before they were to fly . . .
God had revealed the secret—when to migrate.

So They Cut Down the Old Pine Trees

By S. W. BROMLEY

★

A group of ancient white pines near Willimantic, Connecticut, as they were before the axe struck them down. Ranging in height from an estimated 100 to 127 feet, examination of the tree rings after they had been cut revealed ages of from 177 years to about 250. Such groups of ancient trees once were many throughout southern New England but they were largely destroyed for box wood during the century's second decade.

THE Willimantic Pines are gone. I missed their jagged picturesque crests silhouetted against the horizon when I last passed that way. The threat of the cross-cut saw, which had hung like the Sword of Damocles over them so long, had at last been realized.

While I lamented their loss, there would now be compensation. The stumps could be examined and the annual rings counted. By this means, the trees might be cajoled into giving up their secrets of age. I had suspected from the ancient appearance of these grand, old, white pines, with their tall, towering trunks and deeply furrowed bark, that they were probably among the oldest pines left in eastern Connecticut.

Fearing that they might not be much longer for this world, I, several years ago, photographed this strange line of trees, for generations a characteristic landmark along the west bank of the Connecticut River, close to the main highway, at the eastern edge of Willimantic.

There were ten or twelve of these venerable monarchs, survivors of the Colonial period, when I first saw them many years ago. They had successfully withstood the great storms of recent years, including the hurricane of September 21, 1938. The latter catastrophe had, however, left its mark on several. By straining the rooted footholds of two or three nearest the road, the furious gale had been the means of weakening these so that one of the arch-enemies of the pine, the bark beetle, had been able to get in its deadly work, starting the trees on the way to death.

At the time of photographing, I had roughly estimated the heights of the individual trees. Reading from left to right on the photo, the first tree was thought to be 116 feet in height; the second, 127 feet; the third, 100 feet; the fourth, 105 feet; the fifth, 121 feet; the sixth, 109 feet; the seventh, 118 feet; and the eighth, 100 feet. (The three last not shown on photograph.)

Their ages and diameters (a foot or more from the ground) were divulged by stump examinations to be 208 years, 36 inches; 228 years, 27 inches; 177 years, 26 inches; 182 years, 34 inches; 245 years, 36 inches; 217 years, 31 inches; 221 years, 39 inches. The eighth tree was hollow, with a diameter of 48 inches, and showed 200 rings to the cavity nine inches from the center. This was the oldest pine of the lot, its age being estimated at 250 years.

One almost senses a conspiracy during the past five years to destroy our few remaining big pines. What was probably the tallest tree in Connecticut, a towering white pine 145 feet in height, was cut down a few years ago. This beautiful specimen, standing near the village of Mashapaug, in Union, was noted with head unbowed a few months after the 1938 hurricane, but shortly thereafter this tree, together with four or five of its neighbors—all large trees, but dwarfed by the giant in their midst, was laid low.

What age would the white pine in southern New England reach if allowed to live? Professor Spalding of the University of (Continued on page 273)

Black Snake Mothers

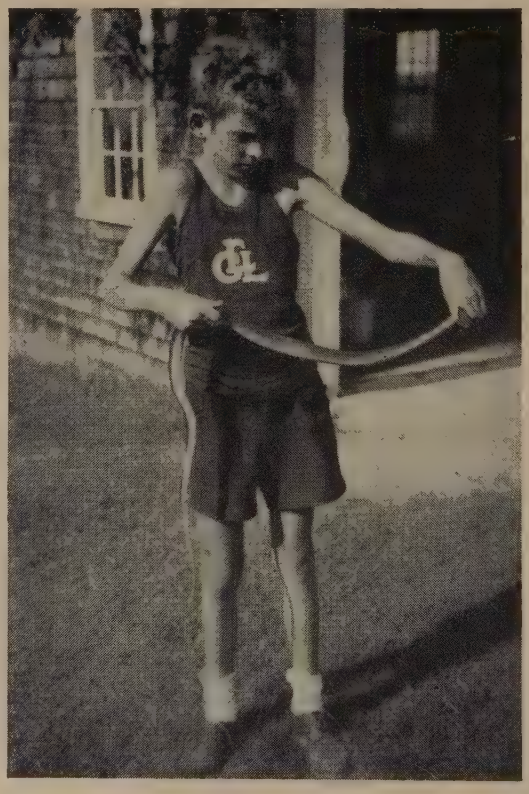
By FREDERIC B. VIAUX

A mother black snake and her twelve eggs. Some hold that the snake will protect her eggs and others that she leaves them to hatch, and the young to make out as best they may. The author believes that study is needed on that point, never having been able to discover evidence of protection.

PROBABLY most people could think of more interesting things with which to experiment than *Coluber constrictor*, the scientist's way of saying common black snake. Many farmers and most city dwellers view these "black devils" with horror and fear, accusing them of misdemeanors from stealing milk from sleeping cows to eating hen's eggs. In reality, they hate milk and would choke to death on a chicken egg.

Since there are so many misunderstandings about these snakes, and some doubts about their habits, some snake students among my friends joined me in learning the truth. Our first step was to catch a black snake, selecting a New England pasture with an ancient stone wall as a likely hunting ground. Our party, divided by the wall, worked down each side, alert for a tell-tale rustle. This noise, and the ripple of the grass as our quarry wriggled to safety, were our only clues to its presence.

Then followed much peering into crevices in the wall for a shiny-black, rope-like body. Discovered, the snake would strike with its ominous but harmless tongue, and bite. We adopted the slogan, "grab 'em and let 'em bite," for their nip, although it may draw blood, is harmless and soon heals. Once completely out of its hiding place, the snake must be held firmly near the head and tail, for it twists and lashes, whipping like a flogger's thong. The tail keeps up an incessant drum-like rattle until the reptile is finally gotten into a cloth bag and tightly tied for its trip home to our laboratory for a period of observation.



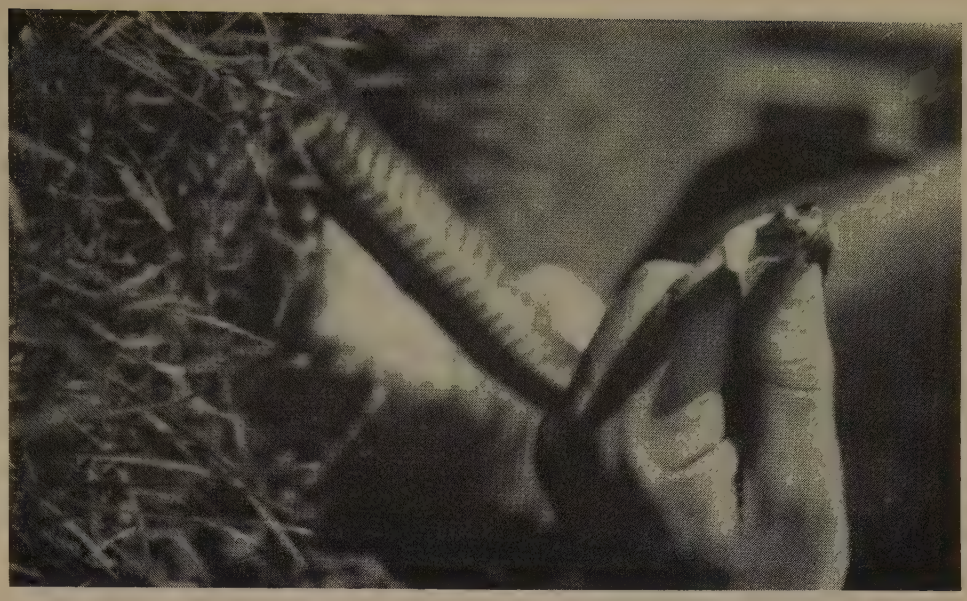
A young herpetologist gingerly holds a harmless black snake on his first encounter with one of these reptiles.

If fortunate, one is able to start soon with a study of the snake's eggs. One beautiful five-foot, three-inch black racer was specially cooperative. After three days of captivity, and on July second, it laid one egg. Nine were laid the following day and one more the third day. These eggs, each about one and three-sixteenth inches long and one inch in diameter, were of leathery texture. They were covered with slightly-raised, salty flecks of pure white on a background of cream color.

Shortly after eggs are laid they are placed in damp sawdust, wood pulp or manure to hatch. One or two are held out to dissect for fertility. If fertile, a tiny, red, watch-spring-like shape will appear near the shell, a dark brown spot in its center; this is the embryo eye. The rest of the egg is filled with a creamy, greenish-yellow fluid, which, when hard-boiled, becomes a solid, mealy paste. This liquid, like the white of a hen's egg, is nourishment for the embryo snake.

Many eggs laid in captivity do not hatch, and it is likely that this applies in the wild, where, also, the eggs provide items in the diet of certain mammals. The infertile eggs soon begin to shrivel and turn brown, or black blotches will appear. There is no odor when an egg is dissected.

No heat is necessary for the incubation of the eggs, for the mother black snake is, like most other snakes, a cold-blooded animal with blood temperature a degree or two higher than the



The author's hand grips an angry black snake. It is necessary to hold it firmly near the head and by the tail when it is captured.

surrounding atmosphere. Also, she does not attend her eggs, although some observers claim to have seen black snake mothers curled up in sawdust piles actively protecting their eggs. I have never found such evidence, but it is something that should be further sought by herpetologists.

By August the eggs have greatly enlarged in size and weight, and have become globular instead of rather cylindrical. Held to a light, the embryo can be seen curled up. It has a relatively large head and a small, translucent body, which occasionally wriggles convulsively.

On September third the first egg from our litter of eleven hatched, the young black snake emerging after cutting a slit in the shell with a sharp, blade-like scale formed for this purpose on its nose. Soon afterward, the cutter is shed. When this first youngster made its way from the shell to the cage floor and lay there moving convulsively, it gave us quite a start. It seemed nothing more or less than an infant milk snake, gray-white with reddish saddles. It is just a trick of Nature, for during the first three years of their lives young black racers are marked much like the milk snake. However, there are definite differences. The belly of the milk snake is black and white checked, while the baby black snake has a mottled white belly. The milk has small eyes and a short stubby tail; the young black, large eyes and a long, whip-like tail.

The average length of the young snakes hatched from seven of the eleven eggs—the others having died—was seven and three-quarters inches, with a diameter of a quarter of an inch.

A smaller black snake mother had laid twelve eggs at about the same time as her compatriot. One of these I boiled for five minutes, cut in half, peeled and ate. The egg contents felt like hard-packed, damp fish roe in my mouth, and was practically tasteless. It came apart in bits and was as difficult to chew as a dried soda cracker. There were no ill effects, but a boiled black snake egg is surely no table delicacy.

A record was perhaps established by one five-foot, two-inch black snake which laid twenty-seven eggs on July eighth. All of these eggs were developed and almost rectangular. Perhaps this was because the snake had been confined to her cage for nearly two and one-half months. The whole batch was laid in two hours and twenty minutes, averaging five and one-quarter minutes per egg.

The egg is worked down by muscular action. When about a half-inch from the cloatha, a yellow, musky-smelling fluid is emitted. Then the tail is raised in an arc so that the anal opening, which is miraculously expanded, is at least an inch above the ground. From this position the eggs skid out amid more musky fluid. During the whole procedure the snake remained quiet and moved only before the emission of an egg. She seemed to be in no pain, but appeared to be rather bored with the business. She was usually gentle while laying, showing no viciousness when prodded. Once the eggs were laid she was ferocious again. None of these eggs hatched.

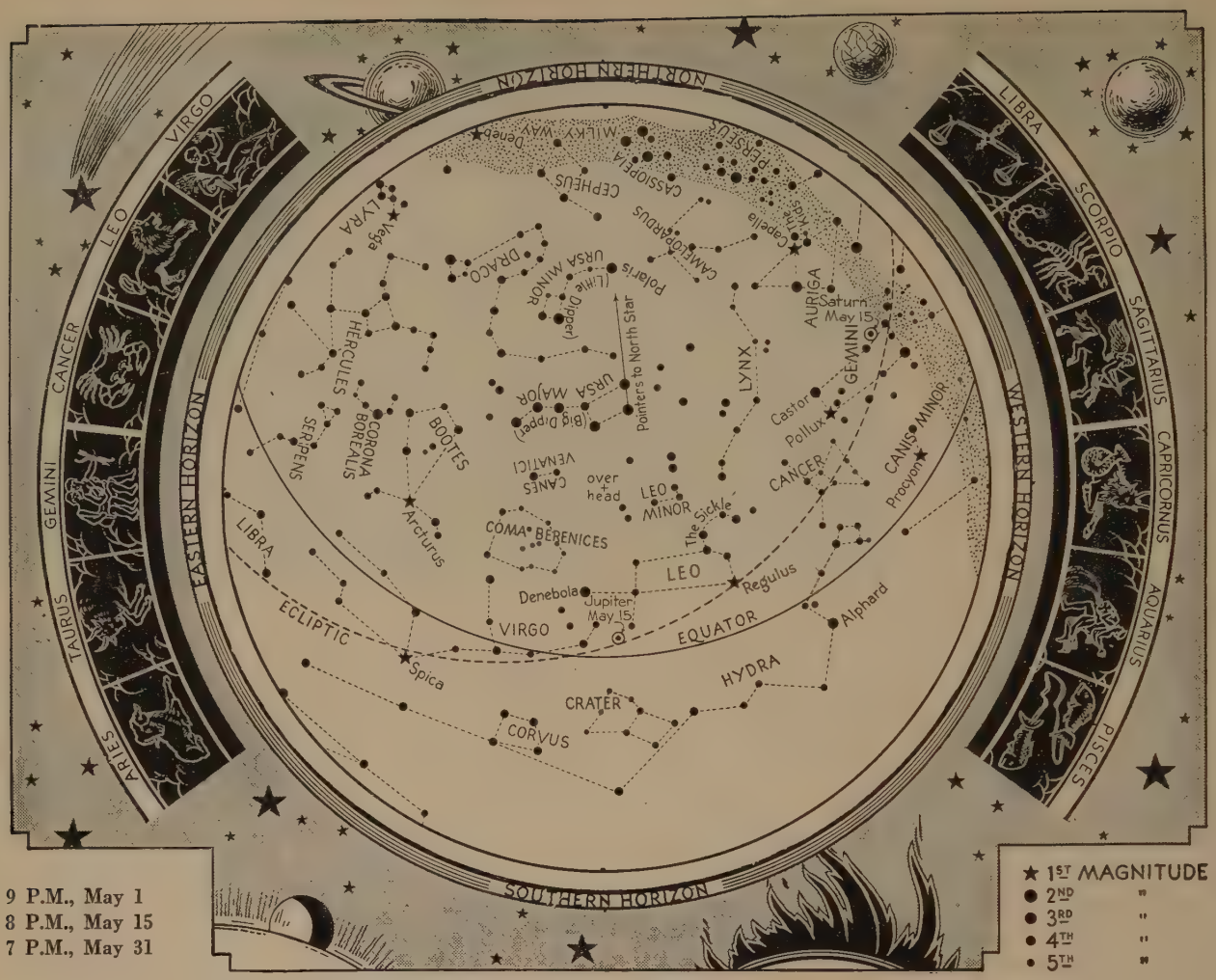
Out of the seventeen young black snakes born, mother ate two, one drowned in the water pan, and the others lived to be returned to a life in the wild.

★

Difficult Diagnosis

By B. R. WEIMER

Twisting on its axis, from pole to pole,
Paramecium acquires a food vacuole;
But I can't tell, with its spiral rate,
What that blasted Ciliate.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Time given is Standard Time; add one hour for War Time.

The Total Eclipse of July Ninth

By ISABEL M. LEWIS

By far the most interesting celestial event predicted for 1945 will be the total eclipse of the sun of July 9. This will be visible, in its total phase, within a narrow path from 26 to 58 miles wide and more than 5000 miles long, and extending from approximate longitude 116 degrees west and latitude 44½ degrees north, in Idaho, to western Turkestan in Asia. It will pass diagonally across Idaho and Montana to Saskatchewan and Manitoba in Canada, across Hudson Bay, Labrador, Greenland, and the North Atlantic, to the coast of Norway at the Arctic Circle, and from there across Sweden and Finland to Lake Ladoga, and through Russia to the northeast of Tashkent, where it leaves the earth at sunset. Partial eclipses of greater or less magnitude will be observable over nearly all of North America, the north Atlantic Ocean, North Polar regions, Europe, western and northern Asia, and the north coast of Africa.

Total eclipses of the sun are rare in any locality. In fact, nine years will pass before another solar eclipse will be total anywhere in the United States. The eclipse of June 30, 1954, will be total at sunrise in Nebraska, the path passing northward into Canada, and there will be an eclipse on July 20, 1963, total in Alaska and passing through the state of Maine. An eclipse on March 7, 1970, will be total in Florida. On February 26, 1979, the path of a total solar eclipse will pass through the northwestern states for a short distance. Then, on May 30, 1984, there will be an eclipse of the type known as total-annular, which changes in part of its course from ring-formed to total. This path will pass over Mexico, Texas, and the southeastern states. It will be the last eclipse

visible in this country, as total, in the 20th century.

The eclipse of July 9 will be visible in the United States in the early morning. The sun will rise more or less eclipsed in the western and southwestern part of the country. The magnitude of the greatest eclipse, which is the part of the sun's diameter covered by the moon at that time, will decrease with distance from the path of total eclipse. Helena, Montana, is about five miles outside of the path, and the magnitude of greatest eclipse there will be more than 99½ percent. At Miami, Florida, the magnitude will be only about 30 percent; in Washington, D. C., 56 percent; in New York 57 percent, and in Chicago about 73 percent.

A pamphlet on the subject of this eclipse has been published as a Supplement to The American Ephemeris for 1945, and may be obtained for fifteen cents from the Superintendent of Documents, Washington, D. C. In addition to astronomical and meteorological data concerning the eclipse, it contains two maps, one of the eclipse region in general, with curves from which can be estimated the times of beginning, ending, and greatest obscuration for any place in this region, and the other a large scale map of the path of total eclipse as it will traverse the United States and in Canada.

A total eclipse of the sun is one of the most beautiful and awe-inspiring spectacles that Nature affords. It lasts for only a few brief moments. The longest possible duration of a total solar eclipse is only seven and one-half minutes; the average length is about three minutes, and the maximum duration of the July eclipse, as it occurs in the North Atlantic between Greenland and Norway, will be only one and one-quarter minutes. In the United States the sun will rise totally eclipsed in Idaho. This will be in a region about 60 miles north of Boise. The line along which the middle of total eclipse occurs with the sun in the horizon passes a mile or so to the west of Cascade in a southeast direction and for a distance of about twenty-five miles. If a photograph could be obtained of the sun rising in total eclipse it would be a most remarkable feat for, so far as is known, no such photograph has even been obtained.

The altitude of the sun will be very low during the total eclipse in the United States, but in Canada circumstances will be more favorable. At Butte, Montana, which is near the central line, the sun will be only about three degrees above the horizon at mid-totality, and the duration of the total eclipse will be about 24 seconds. The small town of Opheim in Montana is almost on the central line of total eclipse, and the sun will be about eight degrees high at mid-totality and the duration of the total phase about 30 seconds. This will probably be the most favorable point in the United States for viewing the eclipse. In Canada conditions should be more favorable the farther north one goes. Very close to the central line of total eclipse are the towns of Ogema, Montmartre, Wolseley, Bredenbury, and Calder in Saskatchewan, and Roblin and Pine River in Manitoba. Yorkton, in Saskatchewan, is only five or six miles distant from the nearest edge of the path, which passes to the southeast of the town. On the central line near Bredenbury the sun will be 12 degrees high and the duration 35 seconds. Although the duration is short and the sun low even under the most favorable circumstances in southern Canada, it may be possible to obtain an image of the eclipsed sun with a small telescope minus its eye-piece, and with a camera attachment from which the camera lens has been removed. It must, of course, be firmly mounted. It is essential to have a long-focus lens, and the exposure should not exceed two seconds, as the earth's motion would become appreciable with a longer exposure. Photographs taken with ordinary cameras would give too small an image to be of any value.

The solar corona is visible only during the total phase of the eclipse, and is a beautiful, pearly white in color. Solar prominences, flames of incandescent calcium, hydrogen and helium, which often shoot outward to heights of thousands of miles above the surface of the sun, may be seen during totality as reddish or yellow protuberances extending beyond the dark rim of the moon. If one is located outside of the path of totality none of the most interesting phenomena associated with the total phase will be seen, and every effort should be made to reach a point close to the central line, where the duration of totality is greatest. At the edge of the path the duration is zero, and even a change of a few miles in position in the direction of the central line will give an increase of several seconds in the length of the total phase.

Baily's Beads is an interesting phenomenon generally seen at the beginning and end of the total eclipse. As the moon advances across the face of the sun from west to east, more and more of the solar surface is hidden by the moon, until finally only a thin crescent is left. The daylight by this time has a weird color. The sky near the horizon may assume sunset hues. The brighter stars and planets appear. If one is at high elevation the approaching shadow of the moon may be seen coming with terrific velocity. The thin crescent breaks up into beads of light, caused by sunlight shining through valleys and depressions on the rough edge of the moon. These are called Baily's Beads from their discoverer. As the beads disappear the solar corona flashes (Continued on page 273)

Song of Vega

By ELAINE V. EMANS

Listen! The Lyre is played again—
Whether by Orpheus or new
Skilled hands I'm not at all concerned.
This matters chiefly to me: when
The night comes down I see the blue—
White lovely Vega, which has burned
So many summers, and I greet
It gladly. And sometimes I fear
It's not the Lyre which sounds so sweet,
But Vega singing to my ear!

The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University
and Director of Nature Education, The American
Nature Association

A POINTLESS ARGUMENT

One might write at length, in support of the above title, about the social, political, military and economic arguments that arise in a world at war, and will continue into the postwar world. While it might be interesting to elaborate on this, the subject would seem more appropriate for the consideration of the social scientist than for the natural scientist. So we will choose an interpretation of the title that refers to the points we get from the ration board.

On an earlier School Page we questioned whether ducks should be considered merely as red points. On this page, we wish to consider the possibility of developing a natural history lesson concerned with a wise use, or conservation, of those all-important blue points found in our ration books in what, to some, seem to be too limited quantities.

If one has looked with envy at a neighbor's book full of blue points, here are some suggestions that might make the situation reverse itself. Of course, if one is so helplessly modern as to assume that a can opener is the first and most important of all household utensils, then our argument may be really pointless, but if one is willing to supplement the choice, high-priced tidbits that come in point-blessed cans with relatively common things that are to be found almost anywhere at this time of year, one need have little worry about not having enough blue points to go around.

Suggested Books

There are a number of good books to help in this. Among the best of these is *Edible Wild Plants of Eastern North America,* by M. L. Fernald and A. C. Kinsey, published by the Idlewild Press. Others, however, have expressed a preference for *Edible Wild Plants,* by that jovial outdoors-man, Oliver Perry Medsger, and published by Macmillan. A smaller but somewhat similar manual has been written for use by soldiers and sailors meeting an emergency in the Pacific. It is *Emergency Food Plants and Poisonous Plants of the Islands of the Pacific,* by C. D. Merrill, published as technical manual 10-420 by the War Department in Washington. In it may be found information on emergency use of some of our Pacific Coast plants.

With these, or similar books, under one's arm, one should be able to sally forth with considerable confidence of beating the blue point bogey to a frazzle. The national headquarters of the Boy Scouts of America has prepared a new manual dramatizing this subject in a splendid way. It was written by Ted Pettit and is based on experiences he has had with boys in the field. He says that the boys were able to subsist off the land and be content, on their return after twenty-four hours in the field, to wait for supper without a supplementary snack. This seems almost too good to be true because, to many boys, the supplementary raid on the pantry is one of the essentials of right living. Nevertheless, Pettit has presented an interesting story that should be read by every Nature and biology teacher. His booklet is called *Nature Adventuring.* It is concerned not only with learning about edible plants, but it uses an understanding of fiber plants, as well, to assist in the capturing of food organisms other than plants.

No Blue Points

For the most part, one versed in the edible items of our environment can put the little blue point book aside for a while. Instead of eating canned asparagus, which has a ridiculously high point value, one can use the succulent new shoots of milkweed, Indian hemp or skoke. I think that one of the most ridiculous things done by the average gardener in spring is to go into his garden and dig up and throw away the bright green winter cress tops that usually are abundant, only to plant in their place seeds of spinach, which must be cultivated to yield a food only slightly better than the destroyed cress.

Here is the briefest summary of some of the commonest, most cosmopolitan plants that may, if properly prepared, equal or excel many things for which some purchasers surrender those famous blue points.

For greens, try using dock, dandelion, chickweed, young chicory, plantain, purslane, or even stinging nettle. The chickweed, young chicory, and even the "pussley" may be eaten raw, or with a little salt or sour grass, but it is better to cook the stinging nettle for obvious reasons. As the season advances, some of these plants will become coarse and strong, but when they are young and fresh they are good eating. A chickweed sandwich, pepped up with some sliced roots of toothwort, is one that you will remember with favor.

It is a bit more unusual, and I think takes a bit more courage, to advise you to try eating the peeled petioles of young burdock, and it requires even more imagination to consider it as the equal of rhubarb, no matter what the books say. If forced into a corner, I might recommend that you try the fiddle-stick fronds of some of the ferns, although, for my own part, I should prefer to feast my eyes on the fully developed fronds than to fill my tummy with their raw or cooked earlier stages. In spite of this, we have, in some parts of the country, a reasonably established market for these fronds, either fresh or preserved, and they *are* good.

Edible Fungi

Of course, many of the fungi are edible, and some of them can be preserved in a dry form from which they quickly recover when water is made available. These fungi make excellent additions to soups, if you do not have the grease to fry them in. In a few months, there will be a special insert in *Nature Magazine,* picturing and discussing some of the more satisfactory of these.

Really substantial foods may be had from such plants as the Jerusalem artichoke and from cattail. The crisp, succulent, underground tubers of Jerusalem artichoke are really delicious and one need have no hesitation whatever in suggesting them as food, either raw or cooked like potatoes. The cattail yields excellent flour from the pollen-bearing top, or from the starch-loaded horizontal underground parts. The first time one pulls up one of these long, substantial cattail bases, and breaks it to see the immaculate whiteness inside, one wonders how anything that appears to be so clean could possibly develop completely surrounded by so much oozing mud.

Really, it seems to me that if anyone uses his head these days, has access to the open country and buys wisely in the markets, there need be little, if any, worry about the food points, red or blue, that are issued by the ration board. I confess that I do not feel quite so confident about the number of points they give me in my gasoline ration book, but that is their business, not mine. Even there, I can beat the game, and beat it honestly, by doing a bit more walking than has been my custom, and, with the walking, I get some returns that, to me, I am sure are most satisfactory.

My Sidewalk

One well-known columnist writes regularly of "My Day," and while my day interests me, too, nevertheless, since I have been walking, I have found a renewed interest in my sidewalk. For a year now, I have been taking pictures of what happens on my sidewalk from the time when, in spring, it is flooded with rain and spattered with tree buds and elm fruits, through the hot, dry summer, when it bears an entrancing border of silhouettes of weed shadows, to fall, when it is paved with leaves, and on into winter, when its snow blanket is etched with the tracks of

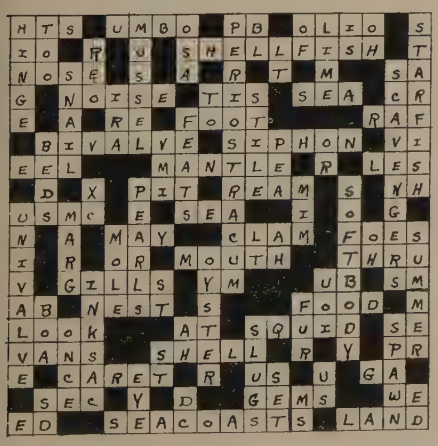
rabbits, youngsters and dignified college professors. With this motive to hold my interest, and to keep me alert to what I can see, the walk from my home to my office is no longer a bore but a pleasure. Had I not walked these last few months I would have missed completely the interesting trail of a deer that ran down the path for a few yards, only to spring aside into snow fully two feet deep. Had I ridden in the Ford, I would not have seen, in early March, where a chipmunk burrowed upwards through eighteen inches of snow and established his own lookout post on a cold pinnacle of ice and crust. Had my ration board given me the fuel I would have liked, I would have missed completely a battle between a spider and a wasp on a hot sun-baked stretch of concrete.

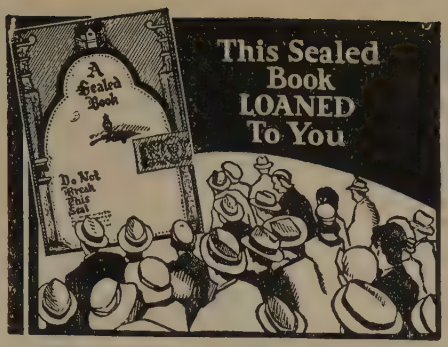
No, I think that it is pointless for us to be disturbed over the so-called small amount of points we are allowed. It is pointless because it is foolish, and if we only make the effort we can live as well or better with what we are issued. More than this, it is pointless for us civilians to be disturbed over such minor matters when there are such major matters to which we could and should give our attention. Even if it is trite, it is none the less true that whether the war ends before this gets in print, or years later, our first, last and only thought should center around the safety, support and success of the young folks who are risking far more than we are, usually in return for less comfort, less financial reward and less opportunity to prepare for the postwar world they are helping to make. Let us stop making pointless arguments about unimportant matters and attend to more important things.

For Herpetologists

Of interest to herpetologists is Bulletin Number 21 of the Zoological Society of San Diego, dealing with the correlations of homogeneous populations. It is the work of L. M. Klauber, Consulting Curator of Reptiles of the Society, and is a scientific bulletin of 101 pages.

Solution of the Puzzle Published in April





THOUSANDS EVERYWHERE ACCLAIM THIS

New Psychology of Life

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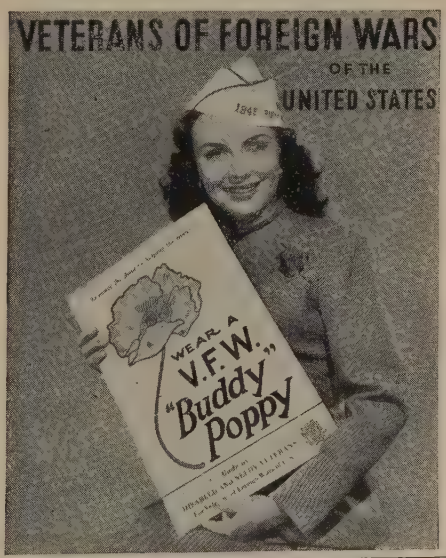

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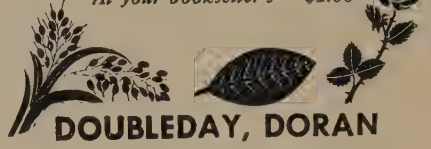

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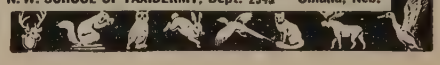

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THE WORLD'S MOST USEFUL LEGS

(Continued from page 240)

diameter of the insect's body. They have given the moth its common name of The Powderpuff Moth. These hundreds of white hairs are believed by scientists to be used in a courtship display at mating time. They are found only on the male and only on his front pair of legs. When not opened up to attract a mate, these masses of white hairs are folded back compactly along the leg.

Strange as is this contribution to an insect's mating display, another, also contributed by the legs, is even stranger. Certain small flies perform a kind of bubble dance at mating time. The males produce frothy bubbles that are made from a secretion of glands carried on their front feet and which contain tiny captured insects that are proffered to the carnivorous females. The glinting balloons of froth, carried through the air, attract the females in one of the oddest wedding-dances in all the world.

While many grasshoppers attract their mates by sounds produced with the wings alone, a few species employ their roughened hind legs as fiddle-bows. They scrape them over the edges of their wings. A row of minute teeth, which look like tiny Christmas-tree bulbs when seen under a microscope, run the length of the inside of the thigh of the hind leg. These teeth, or rasping points, scrape over a sharp-edged vein in the wing to produce the *tsikk-tsikk-tsikk* of the grasshopper music.

During the summer night, at my garden, there are many other insects producing their instrumental sounds. Angular-winged katydids are rasping their wings together high in the maple trees along the border of the swamp. Conehead grasshoppers, their peaked heads making them look as though they were wearing dunces' caps, cling to the feathery tops of the grass-clumps. Among the lower vegetation, the field crickets continue, hour after hour, their shrill, metallic chirping. All of this music seems to be directed to other ears than mine. It is directed to the hearing of the females; to ears that are located on forelegs rather than on heads. The openings of these ears-on-legs vary with the insect. On the forelegs of the katydid, for instance, they are oval, while on those of the coneheads they have the form of two curving slits like quarter moons or parentheses opening outward in opposite directions.

Odd as is the fact that some insects hear with their legs, it seems even more bizarre that numerous other species taste with their legs. A number of butterflies, as well as flies and hymenopterous insects, have demonstrated that their legs carry organs of taste. A Monarch butterfly or a Mourning Cloak or a Red Admiral will pause and uncoil its sipping tongue as soon as its feet touch sweetened water or nectar from flowers.

In laboratory experiments, as soon as a research worker touched the lower part of one of the legs of a Mourning Cloak butterfly with a paint-brush that had been dipped in sweetened water, the insect uncoiled its proboscis. The feet of the Red Admiral seem particularly sensitive to bitter as well as sweet fluids. The tiniest touch of quinine in sweetened water repelled the butterfly when it was tested in the laboratory.

The Monarch apparently uses only four of its six legs tasting. In fact, the front pair — especially in the males — are so atrophied that they are held against the insect's breast most of the time and seem to have but a single use, that of rubbing dust and other dirt from its face. While the other butterflies and moths of my Insect Garden cling with all six of their legs, the Monarch attaches itself to its support with only four. This peculiarity has led to its being given the name of "The Four-Legged Butterfly."

But, in its ability to taste, the Monarch is in no wise handicapped. Its four legs are superior, apparently, to the six legs of some other species. In one laboratory, a research scientist tested one of these familiar black-and-orange milkweed butterflies by giving it water sweetened with smaller and smaller concentrations of sugar. The legs of the insect, he found, could detect surprisingly minute quantities. As a tasting organ in the detection of sweets, his experiments revealed, the leg of a Monarch butterfly is two hundred times as sensitive as the human tongue.

To a cow or a wolf, a horse or a bird, legs are useful, in the main, for standing and for locomotion. They are supports like the legs of a table. But, for an insect, legs supply aids of many kinds, tools useful in gaining a livelihood, sense-organs vital to its existence. The legs of the insects have an importance without parallel among the other animals.

L'AFFAIRE CHIPMUNK

(Continued from page 247)

I call, and usually she answers my "Come, chip, chip, chip; come, chip, chip, chip." She is never absent for any length of time except when she is occupied with the business of pupping. Shortly after I notice that her figure is less trim, even slightly plump, she secretes herself for fully two weeks. When she returns, her figure is slim. Her pinkish teats explain her nervousness.

Whenever a guest wants to have Mom Chip jump upon his hand, I find this can be accomplished more quickly if I make the introduction. When a stranger approaches the feeding stone alone, it takes infinite patience and wheedling to coax her to accept friendship. But when I accompany the suspect, little cajoling is necessary. She readily accepts my okay, knowing that I would never play her dirt and introduce her to a cat.

Mom Chip is beautiful; she is graceful; but she is also ruthless, querulous and selfish in her complete individualism. As the little, wild creature enacts a sneeze or a hiccough when perched upon my hand, I feel a kinship with the beauty and with the frailties of the world. And as her bright eyes are fixed upon me, I realize that it is I, not the chipmunk, who is captivated.

LOOK! STOP! LISTEN!

(Continued from page 264)

intimately—a lovely mourning singing continuously as he fed in near bushes; a rich-hued bay-breasted musing *sotto voce* as he foraged past; a jaunty Wilson's, a luxurious magnolia, and a jet-necklaced Canada, in turn, modeling gorgeous costumes from Mexico, Guatemala, or Peru. We also had four vireo species together that day, and a stunning Caspian tern plunging into the lake. As usual on our final walk, permanent residents and early arrivals buzzed with domestic activity. Spring's magic had wrought an enchanting flow of transformations in two months.

Our festival hall includes scarcely a tenth of the park's seven hundred diversified acres, yet our nine programs present annually between one hundred and twenty and one hundred and thirty-five species—a generous sampling of the Mississippi flyway's great wealth for a tiny section, only ten minutes by streetcar from a metropolitan loop, to offer. But, far more important than numbers, the joy in greeting old bird friends, discovering new, and learning more of spring's eternal mysteries unfailingly renews our inner beings. Vital refreshment more than compensates for any sacrifices involved in scheduling busy weeks to include these days afield. We carry back into man-made turmoil something of Nature's permanence, orderliness, and enduring strength.

THE NEIGHBORS' CHILDREN

(Continued from page 242)

little swallows got tired of her stolen task and drifted away. The rightful parents took up the chores where she left off, quite as though nothing out-of-the-way had happened.

The last that any of us saw of our porch bird-guests was when we watched six fleet-winged tree swallows swing off together for the South. I suppose they were all soon sailing about serenely over Mexican marshes in place of the little northern pond they had left behind. They deserved happy landings after all they put up with that June!

SO THEY CUT DOWN THE OLD PINE TREES

(Continued from page 265)

Michigan recorded a white pine, cut in Michigan during the hey-day of lumbering there, that was 460 years of age and 170 feet in height. It is said that pines more than 500 years old were cut during the Maine lumber boom of a century ago.

The oldest white pine that I have personally examined was one of the famous Cathedral pines of Cornwall, Connecticut, the only remnant of virgin coniferous forest still existent in southern New England. Here, a number of years ago, a large white pine more than 100 feet in height and 32 inches in diameter had been broken off in a storm about 15 feet from the ground. The base of the broken trunk had been sawn off for removal, and on it I counted 308 rings. This indicated an age of about 330 years for the tree. Inasmuch as this grove has been in the hands of the same family for more than 200 years, it seems probable that some of the dominant pines here may be three or four hundred years old.

During the latter part of the 19th Century, the interurban electric trolley companies in southern New England had been instrumental in preserving from the sawmills' insatiable maw, albeit temporarily, many beautiful white pine groves. Such groves were chosen for amusement parks along the trolley lines outside the towns and cities. Years later, as electric railway revenues declined, because of the crushing competition of automobile and movies, many of these parks were abandoned and finally denuded of their pines in the frenzy of box-wood cutting during the second decade of the present century —a fate that also befell many of the beautiful pine groves used for camp meeting grounds, picnic parks and lake resorts.

Unfortunately so many of the watershed and forestry projects during the past 40 years have been planted to red and Scotch pines, both of which are decidedly inferior in every respect to the white, that there has been practically little or no replacement of the Elysian groves of the 80's, and 90's and early 1900's.

Now only single trees or small groups are all that are left of the tall white pines of former years—and the remaining few of these are going all too fast. The violent storms take a few, the insects a few more, but the saw and axe are still the greatest threat to the existence of the older trees.

THE TOTAL ECLIPSE OF JULY NINTH

(Continued from page 269)

forth in all its splendor. This is the time predicted as the time of beginning of totality, and the observer, if he has a watch set to the correct time and knows his position within a small fraction of a mile, may check up on the accuracy of the prediction. Due to an uncertainty of a second or so of arc in the position of the moon the prediction may be in error by two or three seconds, but it is also quite likely that the observer may be as much, if not more, in error in his observation of the exact time of beginning or ending of the total phase.

Observations of value can be made by those close to the edge of the path by recording the nature of the phenomena that they see. These will serve to fix the exact position of the edge of the path and the accuracy of the predicted position.

An interesting phenomenon frequently observed shortly before and after a total eclipse, if one is within the path or a short distance outside of it, is the appearance of "shadow bands," which may be seen moving at moderate speed across the ground or objects in view, as bands of light and shade. They are believed to be an atmospheric phenomenon caused by surface air currents. They were a remarkable feature of the total solar eclipse of January 24, 1925, visible in New York and New England.

The sun will be in Gemini at the time of the eclipse. Among the planets and bright stars visible should be Castor and Pollux, if above the horizon at the time, and stars in Orion, Taurus, Auriga, and, especially, Capella. Saturn will be very close to the sun at the time and Venus should be visible in Taurus, and possibly Mars, west of Venus. Mercury and Jupiter will be below the horizon.

In the month of May Venus will be in Pisces and separating from the sun in the morning sky. Mars is also in Pisces and is getting closer to Venus. Mercury will be at greatest western elongation on May 11, rising less than an hour before the sun. Though brighter than a star of first magnitude at the time, it is not well placed for observation. Jupiter is in Leo and will be a little east of the meridian at sunset. Saturn is in Gemini and high above the western horizon at sunset.

Science Scholarships

Brooklyn, New York, swept top honors in the annual Westinghouse Science Talent Search with a daughter and a son winning the two four-year scholarships of $2400. The girl is Marion Cecile Joswick, who intends becoming a research metallurgist; the boy is Edward Malcolm Kosower, whose chosen field is research in organic chemistry. Miss Joswick has graduated from Manual Training High School in Brooklyn, and Mr. Kosower will graduate from Stuyvesant High School in New York City and go on to the Massachusetts Institute of Technology. One girl and seven boys received four-year $400 science scholarships, and thirty other young scientists received one-year awards worth $100.

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FALCONRY AND CONSERVATION

(Continued from page 261)

example. However, it is also true that, all things considered, the more young leaving the eyries, the better are the chances of maintaining a food-cover limited population. It would be interesting to know if there is a non-breeding "floater" population, some evidence for its presence being the frequent rapid remating after lost breeding birds. Nearby pairs broken by nesting accident is usually a sufficient explanation, however, of an available new mate. It would be extremely interesting to know if a migrating far-northern bird could fill an Appalachian vacancy.

To the extent that young return to the same area to breed (and there is some inferential evidence in the affirmative), the number of young raised in each area determines the local replacement potential. Hence the young removed by falconers should not be from a small single source, but from scattered (and wilderness) eyries. An estimate of three hundred active eyries in eastern United States indicates about a yearly "local" crop of about three hundred birds (analysis of unpublished data may allow an upward revision of this figure). How many of these could falconers "safely" remove each year? We do not know, but it is obviously a small number, and a reasonable guess would be one or two dozen. During the last five years, less than a dozen per year have been taken from nests east of the Mississippi by falconers—but others have been taken from an entirely separate migratory population.

Migrating peregrines, predominantly immature, appear along our eastern seaboard in October (some after over-ocean travel), and disappear from the more northern shores by November. One of these, banded in 1939 by Col. Luff Meredith, America's pre-eminent falconer, was recaptured four years later on the same beach. Another, banded as an eyas by Col. Meredith in southern Greenland in 1941, was picked up dead in Cuba four months later. A number of these slight, straw-colored peregrines have been captured each fall, some to be banded and released, others to be kept as trained falcons. So far falconers have not kept, on the average, more than a dozen of these birds per year, and it is doubtful if this is a significant predation, in view of the following facts. The migratory wave partly coincides with the open season on ducks on the southern coasts, and a good many "duck hawks" are shot each year. Whether this number is to be measured in hundreds is not known, but more than forty are stated to have been shot at one blind in one year, before local falconers "converted" the gunners. In Maryland there is a bounty on hawks, and game wardens along the coast have taken pride in the number shot as vermin. Thirdly, there is much evidence that the migration is mainly off the coast, as the birds are frequently blown in by storms. Mr. Dana Struthers counted thirty-five peregrine falcons and fifty ospreys flying over Boca Raton, Florida, on October 18, 1944, a "hurricane" day with a 40-mile wind from the east. Whether these birds are lost in any numbers during heavy storms is unknown, but the above considerations indicate that the falconer's "take" may be minor when compared with those of the duck hunter, the Maryland game wardens, or the unknown effect of storms.

Whatever these effects are on Greenland and other northern populations, they do not affect the local Appalachian peregrine falcon, of such just concern to all wildlife admirers. Furthermore, most of these passagers escape from the falconers while being flown free, within a few months. It is not known how these later fare. In Europe, however, there is one record of a falcon released in 1916 and shot fifteen years later. A lost eyas, however, is more likely to be shot than the older birds.

It would seem that if falconers, primarily using hawks, confine themselves to a truly small number of eyas falcons from scattered wilderness eyries, and to a yearly dozen or two of northern passagers, there is small likelihood of falconry doing any measurable damage to the peregrine falcon. Obviously, no adult or "haggard" falcons should ever be taken, as there is too much probability that any such is a breeder. And the day that an adult peregrine is trapped at the nest will be a sad one for American falconry.

Besides the peregrine, a few other falcons should be considered briefly. The prairie falcon is also a rare bird, differing from the peregrine in that its population is more dense, but restricted to a limited range. Some interesting remarks on the prairie falcon are to be found in the *Auk* for October, 1944, but we know almost nothing of its population biology. We do not know its abundance, whether increasing or decreasing, we know nothing of extinct eyries, and the relative values of various population controls are unstudied. There is some evidence that this falcon has not suffered the decline so conspicuous in the buzzards, especially the ferruginous rough-leg, the red-tailed, and the Swainson's.

The merlin is a small falcon breeding in the coniferous forest (and sub-arctic) zones of Asia, Europe, and North America. Generally known as "pigeon hawk" in this country, the merlin is seldom captured by American falconers. However, the American kestrel, which is not a "sparrow" hawk as it is so often miscalled, is a smaller species than those of the rest of the world, but it has the same familiar habits. It is trained easily by falconers and is by all means the best "first bird" with which the novice falconer may train himself to handle the larger and more difficult falcons and hawks. The kestrel is without doubt the commonest American raptore.

Goshawks and the bird hawks are variously represented all over the world, and in eastern America they are the falconer's best hunting hawks. The goshawk is often hard to obtain, but the Cooper's and sharp-shinned, respectively a little larger and a little smaller than the very closely-related sparrow hawk of Europe, are widely distributed, hardy birds, with relatively large populations. They are apparently less affected by those conditions that have caused the decline in buzzards, harriers, and kites. The red-tail and the golden eagle are the only buteonines ever used in falconry here, and both rarely, but the former is a good rabbit hawk when properly trained.

While falconry does not seriously threaten any American raptore, its unregulated practice can seriously threaten local peregrine eyries, and there is a definite limit to the number of any rare raptore that may be safely taken. Much of the criticism leveled at falconry is occasioned by the frequently less than responsible actions of boys still in their teens. On the subject of boys and falconry, many centuries ago, Emperor Frederick II had this to say: "He should not be too young, as his youth may tempt him to break the rules governing his art . . . they are not adapted to the tasks required in taming and training birds for the chase, nor should they be allowed at first to fly the falcons. They ought to wait until they not only are skilled in the art but have reached manhood's estate." This is true today.

Mature falconers realize that training hawks requires much painstaking care, and it can be a sport only for the few. While falconers may be unwilling to discourage a new enthusiast, it is also true that the *really* interested cannot be discouraged. Falconers must have rules of conduct strictly adhered to; and further, legislation should be enacted to make practical a licensing of falconers, as in other field sports. Existing game laws should be adjusted to allow falconers, in season, the attempt at taking legal game. Such special rules already apply to archery. The following outline is a suggestion of how such legislation might be applied.

(1) Federal protection should be applied to the peregrine and prairie falcons. (2) Possession permits for the above should be granted on the basis of a recommendation by a committee of both conservationists and falconers. (3) Such a recommendation should be based on the applicant's known ability to take care of hawks and falcons. (4) The possession permit might allow two peregrines or prairie falcons at one time, and a

renewal of one bird per year. (5) The source of the falcons to be stated, and to be either: (a) an eyas from a wilderness eyrie (leaving at least two in the nest), or (b) a passager from the northern migratory populations.

Perhaps the best method for providing for a standard of accepted principles in the practice of falconry would be the formation, preferably within the framework of the Falconer's Association of North America, of an organization consisting of a body of members whose rules and regulations be such that membership indicate a falconry practice consonant with sound conservation.

With regard to the present status of falconry in America, several points remain to be mentioned. Firstly, while some falconers are not conservationists, the overwhelming majority are interested in raptore conservation. Secondly, while the practice of falconry is detrimental to some individual birds, the mere existence of a not inconsiderable body of hawk admirers spread over the country is an excellent framework for hawk protection. The open admiration of all who see the falconer's spirited hawk is reassuring to those of us who are keenly interested in the future of hawks and falcons. While young candidates are frequently a problem, and one that remains unsolved, let us remember that a generation or two ago young boys were afield with gun or egg-collector's box. If the potential of conservation effort on the part of falconers is as yet unrealized, the fault lies at least partly in the youthfulness of falconry in this country. Falconers realize that many local eyries need protection, and hope to put into operation a plan to enlist watchers in all possible areas to act as custodians of each eyrie site. The reports of such "eyrie-guardians" will make possible a study of conditions at each site, and greatly facilitate efforts to bring effective measures to all endangered eyries. Furthermore, such reports will make possible a detailed study of individual eyrie productivity over wide areas, as present data are based on a restricted lower New York State sample.

In conclusion, it should be pointed out that while the peregrine falcon is a rare bird, it is a remarkably stable species, and stability is more important than abundance. Let us recall that the Carolina paroquet was not rare, nor was the passenger pigeon and the heath hen—in fact their very abundance misled us. The peregrine is a rare bird, but all evidence indicates that its special requirements make this unavoidable, and there is no evidence that the species is endangered. Its local eyries do need protection, and most falconers are willing to help.

The following is a partial bibliography on raptores and falconry, particularly in relation to points made in this article.

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Herpetologica

Herpetologica is the name of a journal devoted to the study of reptiles and amphibians and published at the Chicago Academy of Science under the joint editorship of Chapman Grant and Walter L. Necker. It appears irregularly and whenever there is enough material of sufficiently high caliber to warrant an issue. Mr. Grant, who is interested in aiding study in this field in any way, advises us that he would be happy to place regular space in the magazine at the disposal of clubs or organizations specializing in reptiles and amphibians. Write to him at 2970 Sixth Avenue, San Diego 3, California.

California Emblems

Among other helpful folders and leaflets issued in connection with California Conservation Week by the California Conservation Council is one that puts the Golden State in a unique position. This folder pictures and describes five State Emblems for California—the California poppy, the California Dogface Butterfly, the California Valley Quail, the California Grizzly Bear and the Redwood. All States have an official State flower, the majority have official State birds, a few have official State trees, fewer mammal emblems, and, we think, California is alone in having an insect emblem.

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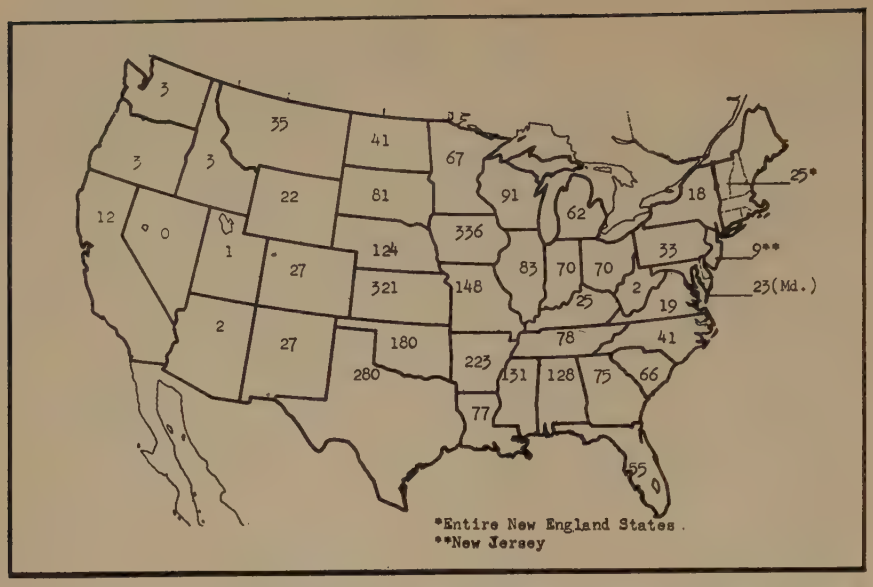


The number of tornadoes reported in each section of the United States for the period from 1916 to 1937, inclusive.

TORNADOES, AMERICAN PHENOMENA

(Continued from page 245)

imately $22,000,000 in property loss was sustained. This was the second of two devastating twisters that have stabbed into this city. On May 27, 1896, a more deadly storm blasted the city, claiming the lives of 306 persons, and wreaking damage to the extent of about $13,000,000.

Three other tornadoes have destroyed property exceeding ten million dollars in each instance—Gainesville, Georgia; Lorain, Ohio; and the tri-State tornado. This last one, which occurred on March 18, 1925, took more lives than any other single tornado. It was a most unusual storm in other respects, also. It began near Annapolis, Missouri, and moved in an almost straight line to Petersburg, Indiana, a distance of 219 miles. It averaged nearly a mile in width. Property to the extent of $16,500,000 was destroyed in Missouri, Illinois, and Indiana, and 689 lives were lost.

Undoubtedly, a tornado is one of the most fearsome and terror-inspiring phenomena in the entire realm of Nature. Eyewitnesses have described the sound as "a horrific whistling roar" and "a hundred Niagaras"; but the consensus of opinion seems to be that it sounds like "a hundred fast freight trains sweeping by."

The violence of the tornadic wind is almost unbelievable. In the Cleveland County, Oklahoma, tornado of April 25, 1935, the first house struck was completely torn to splinters, and of its thirteen occupants, eleven were killed. An orchard northeast of the house was stripped of every twig and branch, and many of the trees were completely stripped of bark. Wire fences were rolled up in great balls. In a number of instances, spokes were torn from wagon wheels, and in several cases the entire wheels—hub and all—were torn from the axles.

On May 27, 1931, a tornado near Moorhead, Minnesota, struck the famed "Empire Builder" passenger train, and one car with 117 passengers was lifted from the track and carried 80 feet into a ditch.

At Gardener Ferry, Missouri, on April 24, 1903, a small frame school building was lifted bodily with all the pupils assembled, and set down twenty feet off the foundation with no one injured.

On April 15, 1921, near Blevins, Arkansas, a farmer, his wife and two children were sitting on the front porch while a severe thunder- and hail-storm raged. Suddenly, with a roar and a splintering crash, a tornado struck the house, blowing the entire house away, with the exception of the porch. Except for a terrible fright, none of them suffered any harm.

Probably one of the most harrowing experiences imaginable happened to the family of Mr. U. H. Wendell, near Syracuse, New York, Sunday, September 15, 1912. When the tornado struck Mr. Wendell's house, it was lifted from its foundation, turned part way around, inverted, and deposited almost on its former site *with the roof downward.* The family escaped from the house by walking on the ceiling and crawling through a window. Excepting a few bruises, no one was injured!

Since these unpredictable storms are likely to occur almost anywhere in our country, it would seem to be the part of wisdom for every citizen to be both tornado-conscious and tornado-wise. Many of the people of our Middle West have prudently constructed caves, the well-known "cyclone cellars," into which they hasten at the approach of any suspicious storm. Thousands have escaped injury or death in these inexpensive underground shelters, which are utilized throughout the year for the storage of fruits, vegetables, and dairy products.

Those who have made a careful study of tornadoes tell us that, where such shelters are unavailable, the cellar of a house offers the greatest security. However, a cellar may be a death trap, and certain precautions should be known and observed.

In the first place, the southwest corner is relatively the safest spot, because, since these storms usually move from southwest towards the northeast, if the house is blown away, or is toppled over, it will in all probability be *away* from this corner. This is particularly true of frame dwellings. Where the walls are constructed of stone or brick, the degree of safety may be substantially reduced.

If one is compelled to remain in a dwelling above the basement, the first floor would be safer than one higher up. An *inside* partition is much safer than any of the outside walls, because these exterior walls quite frequently are blown outward.

If one is caught without shelter, then any depression such as a ditch, or the leeward side of a road embankment, or even a clump of shrubbery will offer some protection. Larger trees are a hazard and their vicinity should be avoided. In one instance, a man caught in the open threw himself prostrate at the base of a sapling to which he clung tenaciously. He escaped without serious injury, although he was thrashed about considerably, and was cut and bruised by flying debris. Streets in cities and towns are quite hazardous due to the menace from flying debris.

If one is on a highway in a car, it is relatively easy to outrun such a storm. By driving eastward and turning north at a convenient north-south intersection, it will usually be possible to evade the path of the storm. There may be an exception when it would be wiser to turn south—that is, if the storm is quite close and moving definitely north of east. Ordinarily, however, a ninety-degree turn to the left will be more likely to place car and occupants outside of the path of danger.

Finally, it should be remembered that thunderstorm weather is always potential tornado weather. If one is alert to this fact, he may remain alive to tell his experience.

Silver Anniversary

On April 6 the Webster Groves Nature Study Society celebrated its twenty-fifth anniversary with a dinner in St. Louis. This may be some sort of a record for continuous activity of a Nature group, but, in any event, it is testimony to the quality of its leadership and the interest of its program. Congratulations.

Trail Walkers

From Ernest A. Dench, Director, Woodland Trail Walkers, Ho-Ho-Kus, New Jersey, comes a fascinating outline of hikes planned for the coming months. A trail leader of long experience, Mr. Dench knows just about all there is to know about the possibilities of trail experiences in the northern New Jersey-southern New York region. His little folders of the hikes, besides giving data on transportation and place of assembly, contain some fascinating thumb-nail descriptions of the routes covered. Hikers in the area are missing a bet if they are not acquainted with Mr. Dench's Woodland Trail Walkers.

United Nations Meeting

In the summer of 1942 Dr. John C. Merriam, one of the founders of the Save-the-Redwoods League, suggested that a California site be chosen for the peace conference to follow the cessation of world hostilities. He suggested that the cathedral-like peace and beauty of a redwoods grove would be a fine setting for the current architects of the universe. Now the city of San Francisco has been chosen for the United Nations Conference in April. Whether Dr. Merriam's suggestion had any part in this selection we do not know, but, anyway, the redwoods are close by and a Conference expedition to them would not be amiss.

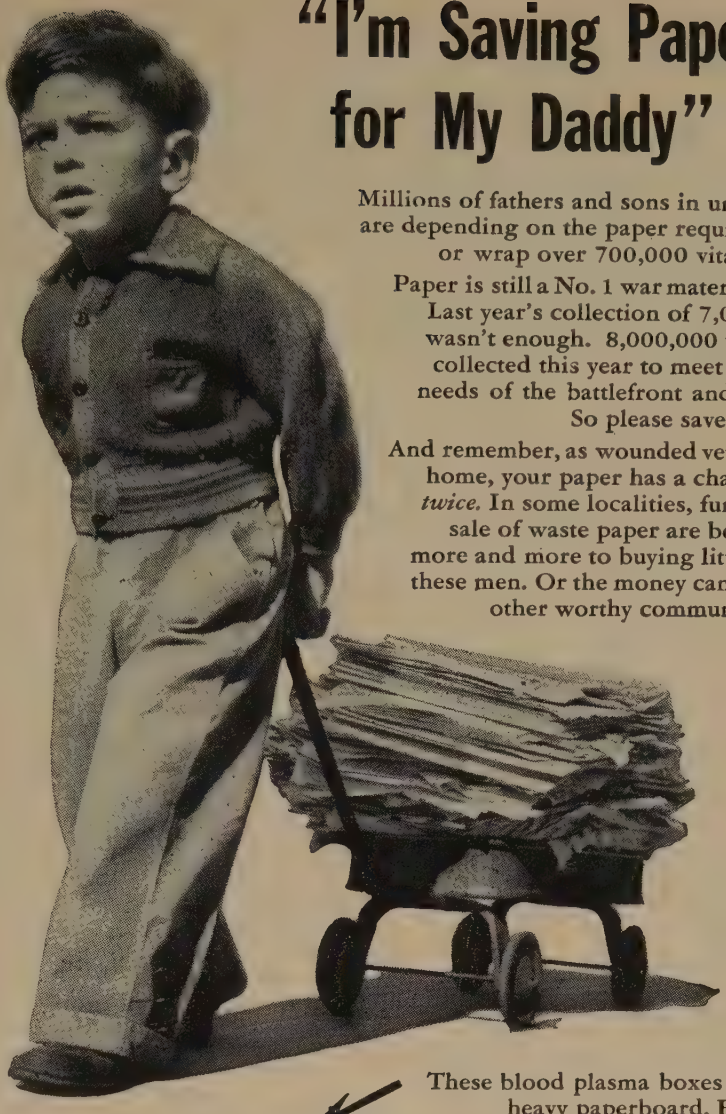
Dog Week

Dusting off its 1944 slogan, National Dog Week will be observed from September 16 to 22. No one could think of a better watchword than that of last year "In War, In Peace, 'Man's Best Friend'" —so it will serve for 1945. The general chairman of the committee this year is Robert L. Ripley of cartoon fame, and headquarters have been opened at 424 Madison Avenue, New York. The week is set aside as a tribute to the dog on the war front and on the home front.

Trees for Tuition

Royle Kornegay owns a farm in Wayne County, North Carolina. He has a son whose long ambition has been to be a doctor. Seven years ago Mr. Kornegay was puzzling as to how he would be able to pay the boy's tuition, and sought the advice of an extension forester. After studying the farm, the forester suggested that 2000 red cedars be planted on two acres of worn-out land. This was done and a three-year total of Christmas trees yielding $1,353.29 has been harvested, with at least one thousand dollars worth more in trees still on the land. Son Dewitt is now a medical student.

"I'm Saving Paper for My Daddy"



Millions of fathers and sons in uniform today are depending on the paper required to make or wrap over 700,000 vital war items.

Paper is still a No. 1 war material shortage. Last year's collection of 7,000,000 tons wasn't enough. 8,000,000 tons must be collected this year to meet the essential needs of the battlefront and homefront. So please save every scrap!

And remember, as wounded veterans return home, your paper has a chance to serve *twice.* In some localities, funds from the sale of waste paper are being devoted more and more to buying little extras for these men. Or the money can be spent on other worthy community projects.

These blood plasma boxes are made of heavy paperboard. Every pint of life-saving plasma is further protected against breakage by a corrugated paper wrapping. It takes a half-pound of waste paper to make one plasma box — and over a million gallons of plasma have been shipped already! That's one mighty good reason for saving paper!

This advertisement prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

Separate and tie in bundles: 1. Wastebasket scraps. 2. Corrugated boxes, brown paper and bags. 3. Magazines and books. 4. Newspapers.

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ON LOCAL PROJECTS

This advertisement contributed to Double-V Waste Paper Program by this publication

Median longitudinal section of anterior end of an earthworm, 8X.

Under the Microscope

By JULIAN D. CORRINGTON

THE PHOTOMICROGRAPHS FROM SLIDES COURTESY OF WARD'S NATURAL SCIENCE ESTABLISHMENT.

The Cornell men all have a yen
To shift the accent far-ward,
Say "As'-caris" and "Lum'-bricus";
Not so at dear old Harvard—
"As-care'-is" and "Lum-brike'-us" stand
Penultimately martyred.

SECTIONING EARTHWORMS

THE average student of biology is astonished upon making the discovery that earthworms have a complex internal anatomy. That lowly friend of mankind, *Lumbricus terrestris,* or any of his close relatives, is Mr. In-between of the animal kingdom, about halfway from amoeba to man. Most of us know the earthworm as a universally favored fishing bait, but Darwin, late in his career, performed a remarkable series of investigations on his own doorstep and discovered how earthworms till the soil and make agriculture possible. They feed on dead leaves and leaf mold in loamy soils, tunneling and eating as they go, then come to the surface to deposit their castings, which consist of a very finely divided and enriched soil. By taking material from below upward they gradually turn the soil over and meanwhile their burrows permit the entrance of water and air.

These worms are members of the Phylum Annelida, or segmented worms, and show most of the characteristics of higher animals, including bilateral symmetry, a complete digestive tube surrounded by a wide body cavity or coelom, tissues and organs formed from three germ layers, the ectoderm, entoderm, and mesoderm, and the body composed of a series of similar segments or metameres. There are well developed integumental, skeletal, muscular, digestive, excretory, circulatory, nervous, and reproductive systems, the only missing anatomical system being the respiratory, present in marine annelids as plume-like or leaf-like gills. Such protuberances would be incompatible with the burrowing habits of the earthworm, but a moist skin richly supplied with blood vessels effects the necessary exchange of gases.

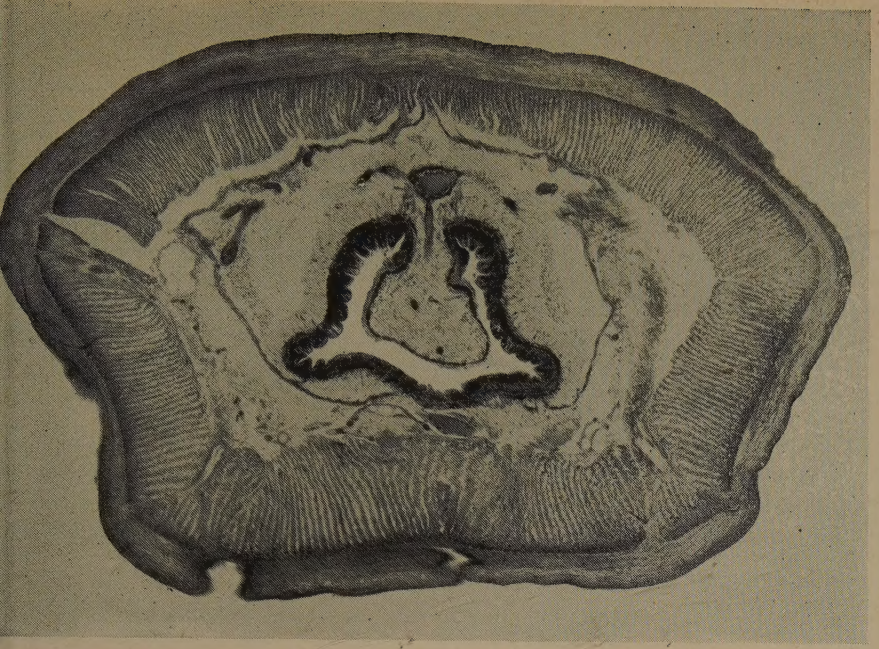
These systems are far above the level of organization of the protozoa or of the simpler many-celled animals, as hydra; yet they are also far below the degree of differentiation and specialization shown in lower mammals and man. Small wonder, then, that the earthworm has long been considered a classic in zoological studies; its organization, size, and abundance make it an ideal form in which to study the structure or function of organs, their aggregation into systems, and the integration of systems into the complete individual. Skin, muscle, nerve, blood, and segmentation are here seen in simple and primitive form; the skeleton is solely of connective tissue, reproductive organs are hermaphroditic; still, earthworms can be taught to run a maze, and can be conditioned to such stimuli as weak electric currents, exhibiting the glimmerings of memory.

Work on the worm begins with a gross dissection and this is followed by a study of microscopic sections. The microscopist will find the earthworm well worth while as a subject, and will discover that good sections are not the easiest of slide preparations, yet not too difficult; they challenge the skill of the worker who has passed his novitiate, but would scarcely be considered as an example of an advanced technique.

Our illustration of the median longitudinal section shows the anterior end of an earthworm, with a prominent mouth cavity leading in to the pharynx, marked by a heavy mass of muscle that enables the worm to suck in its food. Overhanging the mouth opening is a piece that has no mate in the lower half, below the mouth; this is the prostomium, not considered a true segment. Back of this, separated by a slight constriction, and matching up with a ventral part, is the first segment, the peristomium. In the dorsal half of segment three, just ahead of the pharyngeal muscle, is a small, round, dark body, the brain. A similar but smaller body in the ventral portion of the fourth segment is the subesophageal ganglion, marking the beginning of the ventral nerve cord, and connected by a pair of trunks that pass around the pharynx to unite with the brain. The connectives do not lie in the plane of the section illustrated, which also misses the ventral nerve cord, hence these structures do not appear in the photograph. Farther back occur portions of hearts, glands, and parts of the alimentary canal. Several setae show well along the ventral surface, especially in segments nine and thirteen, partially in others. These are small chitinous rods that project to the exterior, four pairs to the segment, moved by special muscles, and effecting locomotion, the worm "rowing" its way through tunnels in the soil by means of these setae.

For purposes of a whole mount of setae, small pieces of an earthworm may be boiled for some 15-20 minutes in 10% potassium hydroxide, rinsed well in water, the setae then picked out with needles and isolated from their sacs and muscles, dehydrated through alcohols, cleared in xylene, and mounted in balsam.

In the cross section illustration, the outermost layer is an epidermis, then circular muscles, and then the thickest of all layers, the longitudinal muscles, looking like a curtain fringe. At one side it may be seen that this layer is terminated by a thin peritoneum, a membrane lining the body cavity or coelom. The dark tube in the center is the intestine, the top wall of which folds down into the cavity of the intestine to make it U-shaped rather than circular. This bulge downward into the gut is the typhlosole, a device that nearly doubles the extent of the epithelial lining of the intestinal cavity, thus greatly in-



Cross section of an earthworm, 30X.

creasing the secretory and absorptive area. This is the most primitive of measures for the purpose, a forerunner of the far more complicated folding into villi seen in the human small intestine.

Just above the typhlosole is the dorsal blood vessel, sending a branch down into the typhlosole and one at either side into the outer cells of the intestine wall, very light in color, and known as chlorogogue cells, with a function comparable to that of the human liver. Below the intestine is the ventral blood vessel. Underneath this in life, but displaced to the side in the cutting of this particular section, is the oval, larger, light-colored ventral nerve cord, easily identified by means of the three round, white objects forming its dorsal border. These three are the giant fibers, longitudinal trunks that permit rapid coordination up and down the length of the worm for strong contractions and speedy locomotion. The smaller dots in the nerve cord are nerve cells that show up well under higher magnification. On the ventral margin of the nerve cord is the subneural blood vessel. At either side, toward the "corners" of the body cavity, are portions of the nephridia or excretory tubules. Part of one seta shows in this section.

Earthworms are best captured at night, between ten and midnight, on warm evenings in late spring and early summer, during or after a rain, on luxuriant lawns. Tread softly and use a flashlight to observe the worms protruding from their burrows. Make a quick grab for your worm, or he will elude you, dashing back into his retreat with unsuspected speed. Keep captured worms in a pail, covered with moist bits of grass, and in a cool place until morning; then transfer them to a laboratory container, such as an evaporating dish, placing the worms between wet pieces of filter paper and discarding all dead or injured specimens. Leave them thus for four days, during which time they will eat the paper fibers and cast out all soil from their intestines. This step is necessary as otherwise the grit in their alimentary canals will nick the sectioning knife, tear the worm's tissues, and render good sections impossible. Many technicians take the extra precautions of inspecting and washing the worms and renewing the filter paper twice each day during the four-day quarantine.

When ready to proceed, after a final cleansing of the selected worms, place them in a vessel, cover them with water, and allow a little alcohol to trickle down the side of the container into the water. Continue to add the alcohol, slowly, a little at a time, so that at the end of two hours the concentration of alcohol in the dish will be about ten percent. This narcotizes the worms and when they will no longer respond to such a stimulus as pricking with a needle, wash them again in water, cut them into small pieces suitable for sectioning, and put the pieces into Zenker's fluid. Half-an-inch of worm will yield hundreds of sections.

Fix for 24 hours, wash in running tap water 24 hours, transfer to 50% alcohol 4 hours, then to 70% alcohol for 12 hours or overnight. Keep containers in the dark during all alcohol treatments. Next the specimens go into 70% alcohol to which a small amount, as one to three drops, of tincture of iodine has been added; enough to give a decidedly yellowish color to the mixture, but not enough to tint it brown. Leave for 12 to 24 hours, changing the solution whenever and as often as the color is extracted; this iodinizing removes mercuric chloride crystals that would otherwise interfere with sec-

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tioning and remain to obscure details of the finished slide.

Change to 83% alcohol for 6 hours, 95% alcohol 1 hour, and 100% alcohol 1 hour, or, better, two changes of 100% 30 minutes each. Now pass to equal parts of absolute alcohol and xylene for 30 minutes, pure xylene 2 hours, and half xylene, half melted paraffin, 30 minutes. Three baths of melted paraffin follow, with 1 hour in each of the first two, half-an-hour in the last. Keep all of these treatments involving paraffin at the lowest temperature at which the wax will remain melted. Imbed a piece of worm in paraffin in a paper boat, taking care to orient the portion properly for cutting. Preferred sections are the two here illustrated; a longitudinal section of the first 10 to 20 somites, and a cross section through the middle of the body.

After sectioning, affix one section per slide and allow to dry for 24 hours, then pass each slide through two baths of xylene, 10 and 5 minutes respectively, hydrate through a descending series of alcohols—100, 95, 83, 70, 50 percents, 2 minutes each, or through two changes of cellosolve, 10 minutes each—and place the slide in distilled water for 2 minutes. Stain with Delafield's hematoxylin, 30 minutes, rinse for several minutes in tap water, pass through acid alcohol for an instant or up to 1 to 2 minutes, until the section appears red, then into several changes of tap water, the last containing a pinch of bicarbonate of soda, until the section is blue. Go back up the series of alcohols to 95% or two changes of cellosolve to dehydrate, counterstain for 1 minute in eosin made as a 0.5% solution in 95% alcohol or cellosolve, go through 95 and 100% alcohols or cellosolve into xylene, 2 minutes, then mount in balsam or permount.

Alternative staining combinations that yield beautiful slides of this subject are safranin and fast green or Mallory's triple stain. Another earthworm preparation of interest is a whole mount of a nephridium. This structure must be dissected out carefully under a binocular or dissecting microscope, and treated as any whole mount, fixing, staining with hematoxylin, dehydrating, and clearing. Before adding balsam and a cover glass, see that the tiny tubule is well spread out on the slide. Very often a minute roundworm parasite, *Discelis filaria,* occurs in these nephridia. Another parasite is the protozoan, *Monocystis agilis,* a sporozoan that feeds on the sperm cells of the worm. Either freshly-killed or preserved worms may be used: dissect the worm and expose the seminal vesicles; slit open one of the larger vesicles and with a fine pipette remove a drop of the fluid contents, or tear a vesicle to fine bits in a drop of water on a slide. Very often all stages of the life cycle of this parasite will be found and can be identified and studied by using any general zoology text as a guide, since this species has long been considered as a type form.

TRADE NOTES

Through the courtesy of the journal *Bios,* official publication of the national biological fraternity. Beta Beta Beta, we are able to offer our readers three interesting booklets. These are entries in the Bios Classroom Series, the first of which, "Introduction to Biological Latin and Greek," by Professor P. H. Yancey, has been reviewed in these columns, resulting in a number of orders.

Number 2 is "The Honeybee, Source of the World's Most Famous Food," by Dr. Frank C. Pellett, Field Editor, *The American Bee Journal.* The article consists of sixteen pages and eight illustrations, and deals with the history of bee culture, the nature of honey, the life cycle of the bee and the colony, modern methods of bee-keeping for pleasure and profit, and harvesting the crop.

Number 3 is "The Oyster," by Dr. R. V. Truitt, Director of the State Department of Research and Education, at Solomon Island, Maryland. Dr. Truitt is well known as one of the country's outstanding authorities on the oyster, its life and environment, and methods of conservation. His paper deals with history, biology of the oyster, and its economic importance; 12 pages, with 3 illustrations.

Number 4 is entitled "In the Beginning" and deals with the origin of life. It is by Dr. C. T. Hurst, of Western State College at Gunnison, Colorado, and is a sixteen-page pamphlet with three illustrations. The author discusses briefly the various theories for the origin of life on our earth that have been popular at various times, then describes in some detail the modern physico-chemical views.

These booklets, numbers 2, 3, and 4, are priced at ten cents each, but have been made available to readers of this Department for postage costs alone. Send a three-cent stamp for *each* publication wanted and ask for it by number and title. Address Dr. Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St., N.W., Washington 6, D. C.

APPLE POLISHER

One of the most debatable subjects in connection with the laboratory portion of the beginning course in biology or zoology concerns the proper species with which to start the work. In general, the question simmers down to low forms versus high forms, as exemplified by amœba and frog, respectively. If the course is general biology, certain exercises and experiments on protoplasm, regardless of the systematic position or number of species used, appears logical, followed by work on the cell, including unicellular organisms, simple histology, and cell division. If zoology is the subject, there are adherents for each of the schools of amœba, paramecium, grasshopper, frog, white rat, and fetal pig. Botanists nearly always start with a complex plant.

The lower-forms system has two advantages: simplicity of material and, of great importance, beginning at the beginning. On the other hand, it has two rather sizable disadvantages: introducing the student to the subject by way of unfamiliar material, and by the use of an unfamiliar instrument, the microscope. Nearly every class using a low-forms method must start, not by studying some representative of the animal kingdom, but by studying the microscope, the means to an end.

The high-forms system has a great claim on a favorable vote in that it employs an animal—whether insect, frog, or mammal—known to everyone, and the student feels that he is getting right to the core of the subject at once, with anatomy and physiology. The frog and mammal, particularly, present many terms already familiar, as intestine, heart, brain. Sufficient new vocabulary is given at each period to keep the student on his toes, but it is not all a *terra incognita.* This system has the disadvantage that, after completion of the first specimen, generally in considerable detail, the novice must then go back to the beginning and start climbing up the evolutionary ladder from the bottom rung, finally reaching the place where he began. However, after finishing such an animal as the frog, one is rather well into the course and a transition of this nature is then not so difficult.

When the course is over, the student will probably have about as good an idea of its entire content and the meaning thereof, regardless of which system is employed in the laboratory. What is presented is not as important as how well it is served up. No introductory course can cover the whole field thoroughly. If the sampling is representative and main principles included, the objective of the course will have been met.

Nearly any textbook can be adapted to meet any chosen sequence in the laboratory; it is not difficult to skip about in the text. However, if a published laboratory manual is used, it is better to stick to the assignments in the order in which they occur; choose a manual written according to the way you prefer to give the course or else subordinate your personal wishes to suit the manual required or selected. Since it does not matter too much which system is used in laboratory procedure, and since the student knows naught of the problem of low forms versus high forms, less confusion and better teaching will result if the manual is followed in the order the author has presented his material.

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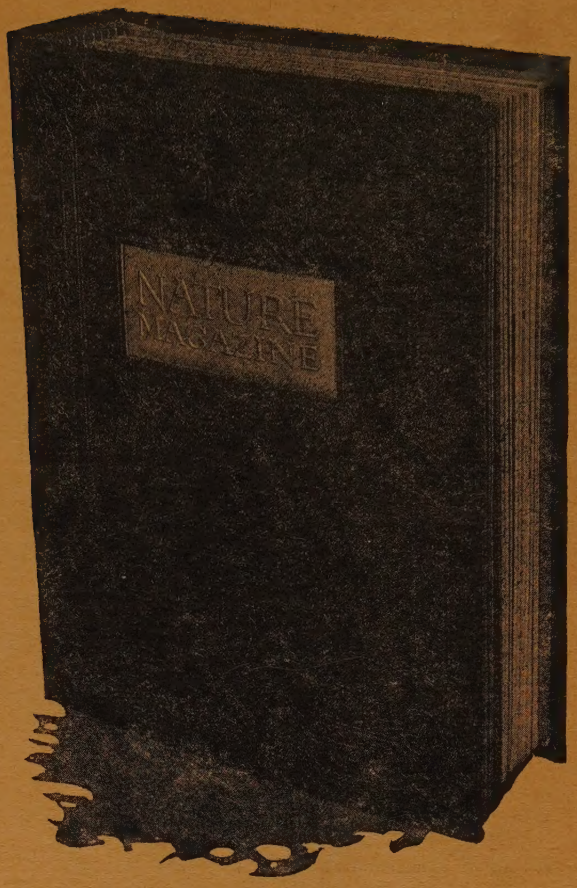

"Where's the latest copy of Nature Magazine?" How often you have heard that question! And how often an answer like this: "Look on the chair . . . over in the corner!" Like as not, the much desired copy will turn up under the cushion in the window seat. And great will be the lament at torn pages and creased pictures.

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